Chemical Age

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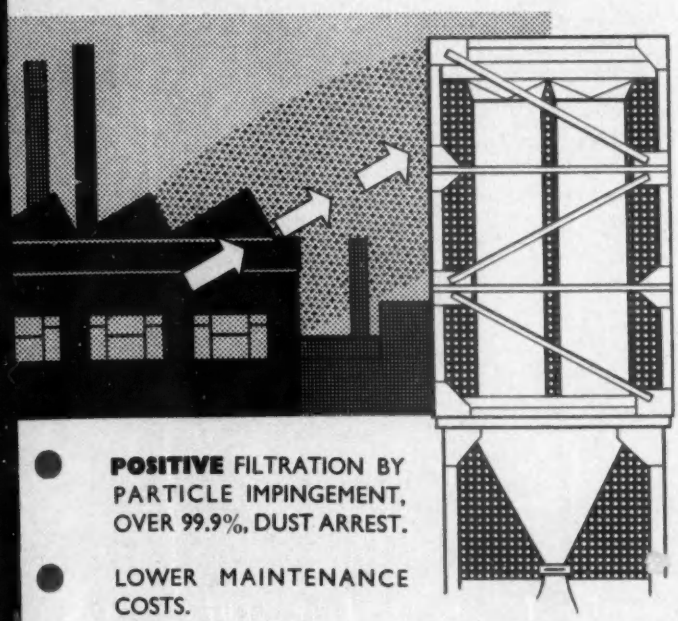

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INDEX TO ADVERTISERS

The first figures refer to advertisement in **Chemical Age Year Book**, *the second to the current issue*

continued on page 468

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DISCS

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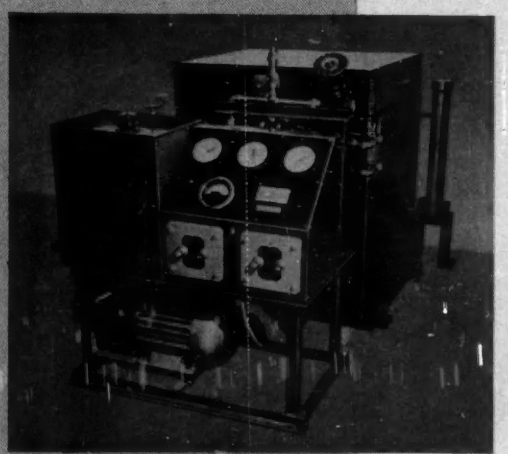

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'M' PUMPS Accurate metering pumps suitable for most liquids; flow variations obtainable by micrometer adjustment of stroke.
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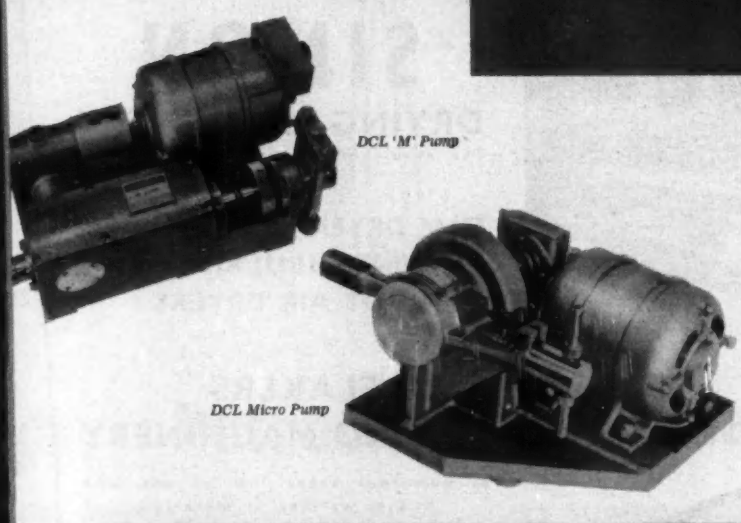

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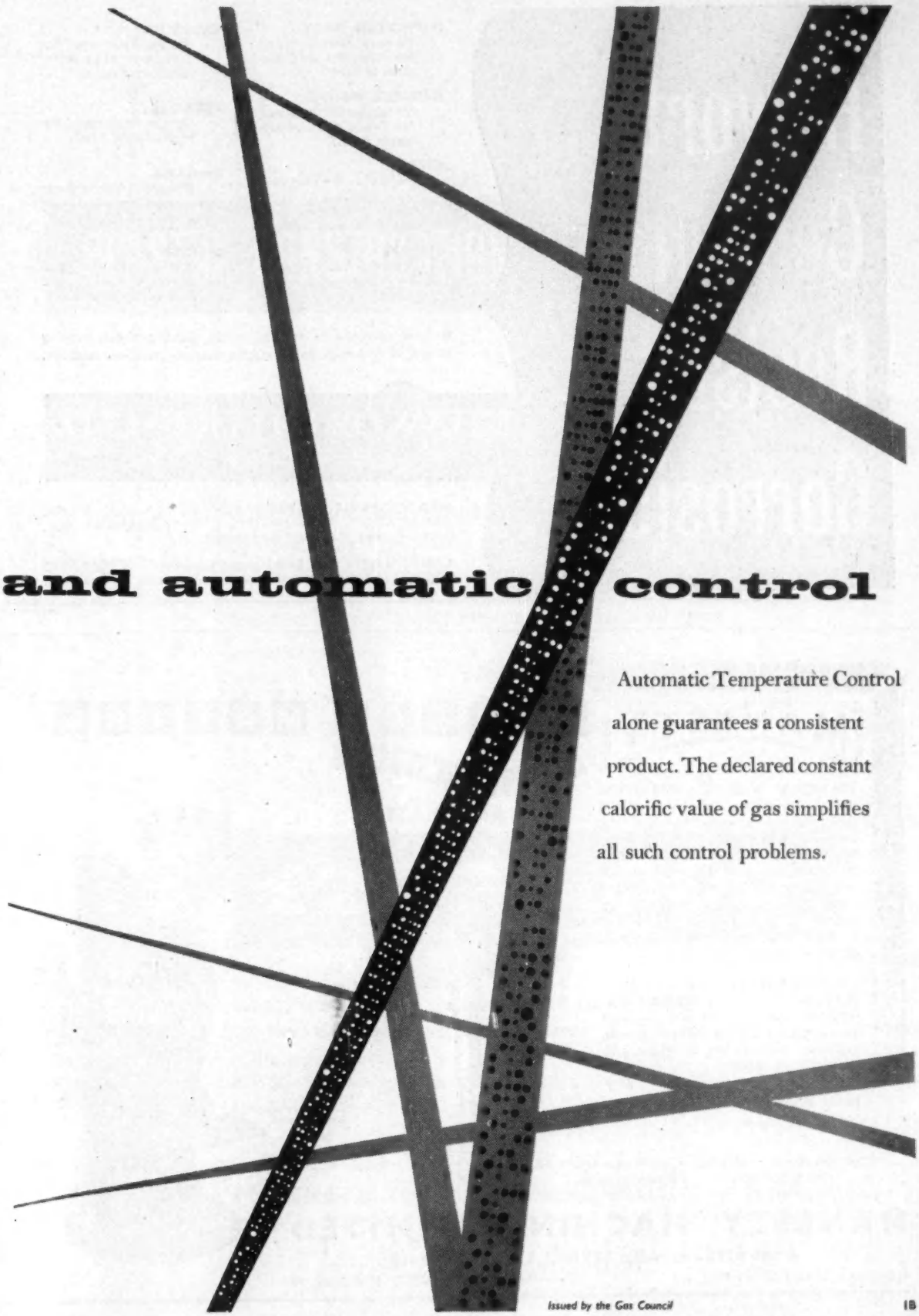

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CHEMICAL AGE

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PLANT INVESTMENT

IT is perhaps appropriate that in this issue of CHEMICAL AGE which is devoted particularly to chemical plant and engineering, information is recorded of the British chemical industry's widespread activities (see p. 492). For the information is published at a time when the Government has just announced, in a new drive to halt inflation and maintain the value of sterling: increased Bank Rate from 5 to 7 per cent; a brake on investment spending by Government departments, local authorities and nationalised industries, so that expenditure will be held to this year's level of £1,500 million; asked the banks to hold private sector loans to the average of the last 12 months (about £2,000 million); and, informed the Capital Issues Committee to take a 'more restrictive and critical attitude towards applications to borrow, and in particular towards applications for large amounts.'

What then is the outlook for the chemical industry? At this early stage it is not easy to forecast the future. But it would seem that if a choice is to be made between chemicals and carpets, then the basic industry is likely to go ahead at the expense of the consumer goods industry. Obviously chemicals are essential to the nation's economy, not only by reason of the contribution they make to every other industry in this country, but by virtue of their own valuable direct exports, which are running at the high level of £260 million a year and also by their indirect influence on the export achievement of other industries.

The Government announcement would seem to leave the Capital Issues Committee some flexibility in interpreting the new curb on capital investment. Undoubtedly, the overall situation will be tougher all round, but chemical industry spokesmen are hopeful that events will show that the curb is harder for some industries than for others. Some in fact consider these latest measures an attempt to cut back spending on luxury and consumer goods industries and believe that basic industries will fare better at the hands of the Capital Issues Committee.

Some of the questions being asked are—will the Government allow the chemical industry to go ahead with its plans for expansion, which place it and its sister, the petrochemical industry, at the head of the most progressive and developing industries in the UK? Will the CIC take the view that as so many industries depend on chemicals that expansion should in the main go ahead, even if some new projects are pruned or deferred?

No one can say at this stage whether existing investment programmes in the course of construction will be allowed to continue as planned. It would seem reasonable to assume that if financial arrangements have already been made, then these would go ahead largely as planned. It must also be probable that where a 10-unit plant was planned, this might be scaled down to fewer units, or that large-scale plants in the course of erection may be slowed down with later completion dates.

The answer by Imperial Chemical Industries Ltd., when CHEMICAL AGE asked for an opinion, was that this company looks upon the 7 per cent Bank Rate as a short-term emergency measure. It is thought that the recently announced Terylene and Severn-side plans are hardly likely to be affected as they are only in the planning stage. No action has yet been taken in respect of financial arrangements—in any event both are long-term projects.

It is believed, however, that Monsanto Chemical Ltd., on the other hand, have postponed a new issue, because of the change in Bank Rate.

There can be little doubt that companies contemplating financial arrangements to cover final phases of new projects or to cover projects still in the planning stage will delay the necessary action.

Having regard to the present situation it is of interest to note that capital expenditure in manufacturing industry next year is expected to be some 5 per cent lower in value than estimated expenditure in 1957. This was discovered from the provisional reply given by 600 companies which provide quarterly information on capital expenditure to the Board of Trade, to an enquiry sent out in May.

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While no doubt capital expenditure by the chemical industry is included in this survey, the projects which are planned by it would not seem to indicate much lowering of expenditure. The hope is therefore expressed that the present restrictions will be short and that the industry will not suffer any injury. It is particularly hoped that the smaller but progressive chemical concerns will not be set back because of financial difficulties. Finally, we enter a plea that research and development projects will not be hindered, or dropped because of the present financial restrictions. For in the long run, the chemical industry's research and development investigations are its greatest assets and are its key to future prosperity and expansion.

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It is interesting to note that it is estimated that 29 per cent of 1957 spending will be for replacement of present facilities and 71 per cent for expansion. Also, the industry's capital spending in 1956 per production worker was $2,637 compared with $1,133 per production worker for all manufacturing industries.

US management expects to exceed this record-breaking expansion rate during the next two years, and the executives appear to have few fears about general business conditions. Their policy is to expand as rapidly as is consistent with their ability to finance projects, to operate them and to find markets for their products. In fact, US manufacturers emphasise that there have been no significant forced curtailments of expansion plans because of national or internal developments.

Depreciation appears to be causing the US chemical industry concern. Under the US income tax laws, the measurement of depreciation in statements of earnings is limited to a recovery of original investment, which thereby ignores the impact of inflation on plant replacement costs. This is stated to be a serious problem for chemical manufacturers because of high fixed assets and rapid depletion and obsolescence of manufacturing equipment. In fact, it is suggested that the present depreciation policy is such that the earnings reported for the industry are overstated and that corporate taxes are being paid on capital consumption as well as on earnings—the 'effective rate' of taxation 'exceeding the nominal rate of 52 per cent in proportion to a company's investment in depreciable property and to the length of the property's life.'

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The various directions in which the British chemical plant industry has developed are related to the requirements of the rapidly expanding chemical industry. In the first place the scale of many chemical projects is now so great that complete plant contracting services are needed. A number of firms in the industry are equipped to carry out such contracting work and have proved their competence in this particular field at home and overseas.

Parallel with the demand for contracting services has been the need for large processing units, particularly such items as distillation columns for the petroleum chemical industry and there are a number of firms fully equipped for their production. Recently one such firm built what is believed to be the largest stainless steel vessel ever constructed. Others have proved themselves in the searching duty of building reactor shells for nuclear power stations. Such items of plant demand not only the ability to form and handle heavy sections but also the ability to carry out erection and welding of the highest order often under difficult conditions on site.

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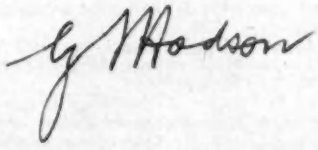


New Chemical Plants in the UK

This special survey of chemical plants opened in the UK since January of this year, or which are under construction or in the planning stage, is exclusive to *Chemical Age*. It includes details of each project and a progress report on the state of construction.

The high rate of investment in UK chemical industry and how the industry by its policy of large-scale expansion and modernisation has kept in the forefront of British manufacturing industry are clearly shown in the survey. A large proportion of the projects represent chemicals that were not produced commercially before the war. Most of the largest schemes are in the petro-chemical field.

The probable effect of the higher Bank Rate on chemical industry investment is discussed in our leading article on page 489.

COMPANY	PLANT	PROJECT
Abbey Chemicals Ltd. (Associate of F. W. Berk & Co. Ltd.)	Second chemical plant for p.v.c. stabilisers	Construction nearly complete
Arthur Ashworth Ltd., Bury, Lancs.	Formaldehyde and hexamine units	In production
Ashburton Chemicals Ltd., Trafford Park, Manchester	New chemical works at Glynllifon Park, near Caernarvon	Planning stage; building to start August 1959
Associated Fumigators Ltd., London E16	Larger fluoroacetamide plant which will increase output by four times	Now being installed. Should be on stream by February 1958.
Beck, Koller & Co. (England) Ltd., Speke, Liverpool 19	Large-scale phthalic anhydride plant	In production, summer 1957
F. W. Berk & Co. Ltd., 1-19 New Oxford Street, London WC1	Organic and fine chemicals factory at Sandridge, nr. St. Albans, Herts, for producing full range of alkyl bromides and other bromo compounds and fine chemicals such as 2-methyl-2 n-propyl 1-3 propanediol carbonate	Operations started during this year
	Increased plant for production of potassium bromate and sodium bromate	Installed
A. Boake Roberts & Co. Ltd., London E15	Phthalate plasticisers plant at Widnes	Expected to be in operation before end of 1957
	Plasticisers—industrial fine and aromatic chemical plants at Stratford being expanded	Work in hand
British Chrome & Chemicals (Holdings) Ltd., Eaglescliffe, Stockton-on-Tees	New chrome chemicals plant	In planning stage
British Geon Ltd., Piccadilly, London W1	Butadiene-acrylonitrile plant (Hycar) at Barry	Is complete and going into production
British Hydrocarbon Chemicals Ltd., Piccadilly, London W1	Propylene tetramer plant	In operation
	12,000-ton polythene plant	Under construction
	Ethylene and ethanol plants	In operation
British Oxygen Co. Ltd., St. James's, London, SW1	Air liquefaction plant at Middlesbrough	On stream
British Oxygen Gases Ltd., London	£1¼ million plant for compressed and liquid and tonnage nitrogen	Under construction
	Plant for 200 tons gaseous oxygen daily	Planned
	Plant for production of liquid oxygen at Glasgow	Planning stage
British Oxygen Linde Co. Ltd., London	Supplying plant for oxygen and nitrogen for ammonia manufacture to Shell Haven	Nearing completion
	Supplying oxygen and nitrogen producing plant to Petrochemicals Ltd., the oxygen to be used for direct oxidation of ethylene to ethylene oxide	Nearing completion; due in operation in 1958

COMPANY	PLANT	PROJECT
BP Refinery (Grangemouth) Ltd., Grangemouth	£4 million extensions include two new copper chloride treatment plants and a 'Petrico' plant for treating oil gases for removal of acids, etc.	Planned
British Titan Products Co. Ltd., Coppergate, York	Sulphur-burning contact plant at Grimsby. When complete will produce 180 tons of sulphuric acid daily	Planned
Carbide Industries Ltd. (British Oxygen Co. subsidiary)	Carbide and acetylene plant in Northern Ireland	Under construction
Chemstrand Ltd., London SW1	Plant designed to produce Acrilan acrylic fibre at Coleraine, NI. Capacity during first stage of operation will be 10 million lb. a year	Under construction; production is scheduled to start mid-1958. Expected completion date by 1959; civil engineering phase completed September 1957
Clayton Aniline Co., Ltd., Manchester 11	Expansion of dyestuffs intermediates plant	Under construction
Courtaulds Ltd., London EC1	Fibro factory near Great Coates, Grimsby, with capacity of 100 million lb. per year	In operation April 1957
	Commercial plant for Courtelle on same site	Due in operation early 1959. First section of plant nearing completion
Joseph Crosfield & Sons, Ltd., Warrington	£5 million plan to rebuild major part of works, concentrating production on north bank of Mersey	To be carried out over next eight years
R. Cruickshank & Co., Ltd., Birmingham 1	New plant for production of fluoride compounds	In operation September 1957
Cyanamid of Great Britain Ltd. (Lederle Laboratories Division)	New factory at Gosport for antibiotic preparations, nutritional products, animal feedstuffs, pharmaceutical and veterinary preparations	Building for factory completed on 12 August. Ducting and air-conditioning to be completed by 1 October. Process equipment to be installed and in production by 1 December
Distillers Co. Ltd., Piccadilly, London W1	New carbon dioxide generating plant completed at Dagenham distillery on 31 July	Now in operation (details to be released shortly)
Dorman Long (Chemicals) Ltd., Middlesbrough	Plant to produce over 30 tons a day of phthalic grade naphthalene at Port Clarence Works. New system of crystallising and centrifuging to be used	Under construction
Dorman Long (Steel) Ltd., Middlesbrough	Largest single unit coking plant with by-product unit	Completed in May
Esso Petroleum, London SW1	£22 million plant at Fawley to produce butadiene and ethylene	Under construction. Due on stream mid-1958
	£18 million refinery at Milford Haven proposed	Planning permission being sought
Fisons Ltd., Felixstowe	£4½ million plan for production of nitrogenous fertilisers, including 250 tons per day nitric acid plant	Site work started; contract awarded for plant
	New granulating plant to produce 60,000 tons granular fertilisers annually at Cattledown, Plymouth	Opened in April
Forth Chemicals Ltd., Piccadilly, London W1	Major plant extension for production of monomeric styrene. Output sufficient to supply present domestic usage	Now operating
J. Garroway Ltd., Scotland	Sulphur-burning sulphuric acid plant with daily acid capacity of 150 tons	Under construction
Grange Chemicals Ltd., Piccadilly, London W1	Low pressure polythene plant to produce at Grangemouth 11,000 tons a year	In planning stages
Hardman and Holden Ltd., Manchester 10	Stabilised sulphur trioxide plant	Now in operation
Hickson and Welch Ltd., Castleford, Yorks	17-acre site purchased adjacent to Castleford plant for expansion plans	—
Imperial Chemical Industries Ltd., London SW1:	£100 million petrochemical plant planned for Severn site	Planning permission being sought
Alkali division	Pioneer plant for calcium silicate, aluminium silicate and silica fillers	In operation summer 1957. Full production expected by 1958
	£7½ million extensions and modernisations to extend Lostock capacity for light ash production and to expand Winnington alkali capacity	To be carried out over next few years

COMPANY	PLANT	PROJECT
Billingham division	Topanol 'O' plant with 1,600 tons annual capacity for lubricating oil and gasoline antioxidant	Scheduled for operation by mid-1958
	Oil gasification plant for production of ammonia from oil	Nearing completion
	Expansion of Nitro-chalk plant	Planning permission sought in February and granted
	Extension at Heysham for two ammonium oxidation plants for nitric acid	Planning stage
	Catalyst factory at Clitheroe, Lancs., to serve fertiliser ammonia production, oil industry and petrochemical plants	On stream end September 1957
	22 million lb. nylon polymer plant	To be in operation shortly
	Second carbonylation plant; butanol output increased by seven times	Now in production
	Extensions for methanol, isopropanol, butanols and higher alcohols, also for plants manufacturing phenol, octylphenol	Planning stage
	Third ethylene plant; to bring total capacity to 100,000 tons a year	Scheduled for production early in 1959
Dyestuffs division	New plant for isocyanates	Now operating
Fibres division	8 million lb. extension to Terylene capacity	Due in operation at end of next year
	New 20 million lb. Terylene plant	Plans well advanced
General Chemicals division	Extension to Arcton plant at Runcorn	Now in operation
	Further additions to chlorine-using plants, particularly chlorinated solvents	Planning stage
Metals division	Vacuum arc melting plant for production of 2,000 tons annually of double-melted titanium ingots	Under construction
	£2 million titanium fabrication works	Plant installed and certain units now in operation
Nobel division	Additional capacity for silicones production	Now being installed
	New plants for isopropyl nitrate	Under construction
Paint division	New resin plant at Slough	Almost complete, some units in operation
Plastics division	Extensions to Welwyn Melinex plant	Completed and in operation
	Melinex plant planned for Darwen in Lancashire	To be built shortly
	Extension of Hillhouse p.v.c. capacity	Now complete; production being built up to 55,000 tons-a-year capacity
Wilton Works	10,000 tons-a-year plant for production of Butakon styrene-butadiene	Nearing completion, bulk production under way
International Synthetic Rubber Co. Ltd., Hythe	£5 million plant at Fawley to process butadiene for GR-S rubber. Designed to produce 50,000 tons annually	Under construction
Ellis Jones & Co. Ltd., Stockport	Sulphonated oil plant extension to increase production by one-third	Now in operation
Lancashire Tar Distillers Ltd., Manchester	£25,000 enlargement of phenol and cresol plants at Cadishead. Extraction capacity increased to 1,500 tons a month	In operation
	Rebuilding of benzole plant destroyed by fire in May 1956	Construction began May 1957 scheduled for completion by December 1958
	Tar distillation plants	Under construction
Lankro Chemicals Ltd., Eccles, Manchester	£100,000 storage facilities for handling of liquids	To be built over next three years
Laporte Titanium Ltd., London W1	Sulphuric acid plant to produce 175 tons a day at Statlinborough	Commissioned
Lobitos Oil Fields Ltd., Ellesmere Port, Cheshire	Plant designed to produce either sodium or calcium sulphonates for detergent additives to lubricating oils	Under construction

COMPANY	PLANT	PROJECT
Manchester Oil Refinery Ltd., Manchester 17	Capacity of chemical treatment plant being increased	Trial runs mid-summer 1957
	Plant for the finishing of petroleum sulphonate soaps and recovery of alcohol	Contract awarded; under construction
May and Baker Ltd., Dagenham, Essex	Norwich plant for Tropotex weedkiller production	Opened in May 1957
Midland Tar Distillers Ltd., Birmingham	Continuous tar distillation plant to separate 300 tons a day of crude tar into primary fractions and refined tar or pitch	Under construction
Ministry of Supply, ROF, Ranskill, Notts	Plant for the continuous concentration of 63 per cent sulphuric acid up to a strength of not less than 95 per cent	Under test
Monsanto Chemicals Ltd., London SW1	New plant for cyclohexylamine manufacture at Newport, Mon.	In full production from March 1957
	4,000 ton styrene-butadiene copolymers plant at Newport	On stream autumn 1957
	Plant for maleic anhydride at Newport, Mon.	On stream summer 1957
	Plant for phthalic anhydride at Newport, Mon.	Under construction; scheduled for operation by end of 1957
	£8½ million plant at Fawley refinery to produce polythene and other petrochemicals	Under construction; polythene plant should be in production by 1959
Murex Ltd., Rainham	Plant for production of tantalum and niobium	Scheduled for operation in 1959
Newton Chambers & Co. Ltd., Thorncliffe, Sheffield	Plant for hydro-refining of crude benzoles. Commercial development of Coal Tar Research Association process	Pilot plant constructed
Petrochemicals Ltd., Partington (Shell Chemical Co. subsidiary)	Ziegler polythene plant with 1,000 tons annual capacity	On stream summer 1957
	Direct oxidation unit	To be erected in 1958
	Plant for production of ethylene oxide	Planning stage. Due in operation in 1958
P. R. Chemicals Ltd., Silvertown, London	Plant for batch rectification of various tar acids to be used in conjunction with recently extended continuous tar acids plant	Plant being commissioned
Prices (Bromborough) Ltd., near Birkenhead	Second Emersol unit for production of stearines and oleines	Completed in June
Sadler and Co. Ltd., Middlesbrough	£250,000 extension scheme to coke ovens and by-products plant at Evenwood. Substantial increase in output of crude tar and crude benzole	In operation early September
Scottish Agricultural Industries Ltd., Leith	£3 million works for concentrated fertilisers based on ammonium sulphate	Coming into operation this autumn
	New phosphoric acid plant	Equipment being installed
Scottish Tar Distillers Ltd., Falkirk	Continuous tar distillation plant to produce commercially pure phenol xylenol, orthocresol and meta-para cresol	Under construction
South Eastern Gas Board Ordnance Wharf Works, Greenwich	Plant to produce 15 tons a day of phthalic grade naphthalene with high yield of product. Also production of refrigerated grade of cresylic creosote	Under construction; scheduled for operation in autumn 1957
Shell Chemical Co., London	Ammonia and nitric acid plant for the production of Nitra-Shell; at Shell Haven	Plant being installed
Stavely Iron & Chemical Co. Ltd., Sheepbridge	Carbonisation plant with daily production of 18 million cu. ft. of gas	Planned for completion in 1961
John & E. Sturge Ltd., Birmingham	Production facilities for Calofil (precipitated calcium carbonate) expanded by 300 per cent	In operation summer 1957
	£250,000 expansion scheme to increase citric acid output by 70 per cent	First stage completed February 1957; completion expected by March 1958
Union Carbide Ltd., London	£3 million plant at Fawley for production of ethylene and oxide derivatives. Capacity 45 million lb. annually	Scheduled for operation in 1959
	£4½ million polythene plant at Grangemouth with 12,000 ton capacity	Due on stream in October 1957
United Coke & Chemicals Ltd., Sheffield 10	New plant for phthalic anhydride grade naphthalene. Replaces hot pressing plant destroyed by fire	In operation September 1957
Workington Iron & Steel Co. Ltd., Workington	Production of gas, tar, refined benzole and sulphate of ammonia will be increased by a new battery of 53 coke ovens commissioned late summer 1957	Planning stage

News of Plant Projects

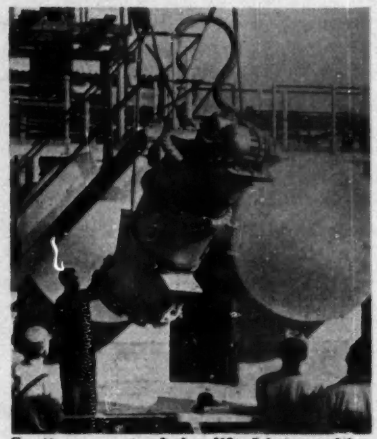
COSTAIN-JOHN BROWN'S WORK ON FOUR UK PROJECTS

AT PRESENT engaged on four chemical engineering projects in the UK are *Costain-John Brown Ltd.*, London W1. A major contract is the engineering and construction of Chemstrand's £3½ million Acrilan synthetic fibre plant at Coleraine in Northern Ireland. This plant is scheduled for completion by the beginning of 1959 and is designed to produce 10 million lb. of Acrilan fibre each year during the first stage of operation. All the divisions of the company—engineering, construction and plant—are employed on this contract with the engineering division consisting of chemical, civil, instrumentation and electrical engineering and drawing office sections.

Chemstrand Project

The Chemstrand plant project is an example of the 'turn key' system of contracting for which Costain-John Brown are particularly suited. Under this system the company undertakes a contract in its entirety—major sub-contracting is avoided and control and supervision is unified with responsibility vested in only one company. In other words, a client can state in general terms what product he wishes to make and in what quantity and the contracting company hands over a plant turning out the stated requirements. The Chemstrand plant will include numerous modifications and improvements gained in operating experience with a US factory, and existing plant and processes will be related to British Standards and the materials and equipment available in the UK. The civil engineering phase on the plant is virtually completed and the mechanical engineering phase is about to start.

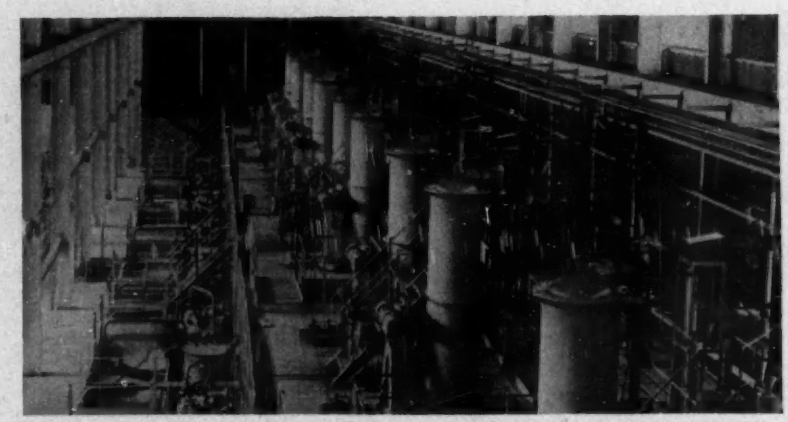
Another important undertaking by the company is for Lobitos Oil Fields Ltd., at Ellesmere Port, Cheshire, where Costain-John Brown have engineered and are at present erecting a plant. This is designed for the production of either sodium or calcium sulphonates which will be marketed as detergent additives to lubricating oils.



Scott evaporator being lifted into position on supporting structure at the Lobitos plant

The company have also almost completed the design, supply, erection and testing of a continuous sulphuric acid concentration plant at the Royal Ordnance Factory, Ranskill, Nottinghamshire. This plant is designed for the continuous concentration of 63 per cent sulphuric acid of up to a strength of not less than 95 per cent. In co-operation with the Chemical and Industrial International Ltd., Costain-John Brown, are engineering and erecting two plants for the production of ammonia-based fertilisers for Fisons Ltd., at their new factory site at Stanford-le-Hope, on the Thames estuary.

Costain-John Brown Ltd., are also undertaking for Fisons, the engineering and construction of off-site facilities associated with these plants.



A line of stills in the main process building of the sulphuric acid concentration plant at the Ranskill Royal Ordnance Factory

Two Phthalic Grade Naphthalene Schemes by Proabd

NOW being built by *Proabd (England) Ltd.*, 9-10 Marble Arch, London W1, is a plant to produce more than 30 tons a day of phthalic grade naphthalene for Dorman Long (Chemicals) Ltd. at their Port Clarence Works, near Middlesbrough. The plant uses the system of crystallising and centrifuging developed by the company. The product can be produced in either solid or liquid form.

A similar plant is being designed and installed for the SE Gas Board at their Ordnance Wharf Works, Greenwich, to produce a minimum of 15 tons a day of phthalic grade naphthalene, with a high yield of product, combined with the production of the Board's refrigerated grade of cresylic creosote. This installation incorporates two types of centrifuge by Sharples Centrifuges Ltd.

Proabd are also constructing a large tar oils concentration plant for Lancashire Tar Distillers Ltd. at their Cadishead Works, near Manchester. This utilises a newly-developed system of distillation trays and a natural circulation radiation pipe-still. Another project in hand is a continuous tar distillation plant to separate 300 tons of crude tar into primary fractions and refined tar or pitch. This is being built at the Nechells, Birmingham, works of the Midland Tar Distillers Ltd.

A plant for the batch rectification of various tar acids is now being commissioned for PR Chemicals Ltd. at their works in Silvertown, London. It will be used in conjunction with the continuous tar acids plant of Proabd's design which has been in production since early in the last war and which is, with recent extensions, said to be the largest single tar acids plant in the country.

The company is constructing for the Scottish Tar Distillers Ltd. a large continuous tar acids refining plant to produce commercially pure phenol, xylenol, orthocresol and meta-para cresol at their Falkirk works.

Contracts in Hand by Petrocarbon Developments

Contracts at present in hand by *Petrocarbon Developments Ltd.*, 17 Stratton Street, London W1, include the complete engineering and supply of equipment for a plant for the finishing of petroleum sulphonate soaps and the recovery of alcohol for the Manchester Oil Refinery Ltd. Other work includes the engineering and supply of an evaporation unit for thermosensitive miscella, with an extract solution capacity of 13,000 tons a year, the engineering design study for a plant for the production of heavy water by the distillation of hydrogen at -250°C, and the complete engineering of a polystyrene plant designed to produce 5,000 tons a year of general purpose and high duty polystyrene for Polimex, Warsaw.

Refrigeration Equipment for World's Largest Penicillin Plant

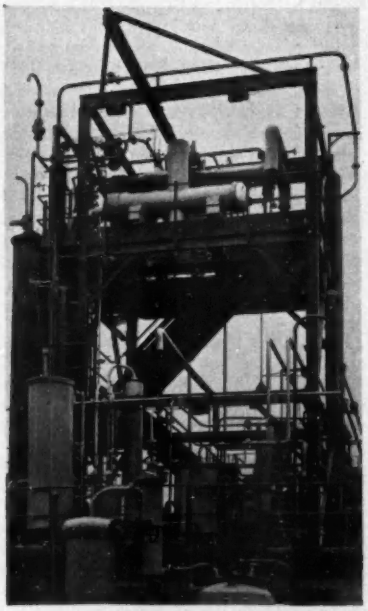
REFRIGERATION equipment for the world's largest penicillin plant, designed and operated by The Distillers Co. for the Ministry of Supply, at Speke, Liverpool, was supplied by *UD Engineering Co. Ltd.*, Park Royal, London NW10.

The equipment comprises three separate installations. The first, plant 1, has to supply 30,000/36,000 gallons of water an hour at 35° F. To ensure continuous operation, standby compressors, condensers, liquid pumps etc. were installed.

Plant 2 was supplied in triplicate, two working and one standby, and each of the three sections has to be capable of eliminating 132,000 BThU an hour with a final evaporation temperature of -100°F. The evaporator load is subject to wide varjations, from 30 per cent of normal capacity to 100 per cent overload.

Plant 3 controls the temperature at 40°F in a cold storage space of about 60,000 cu. ft.

UD equipment is also in action in the

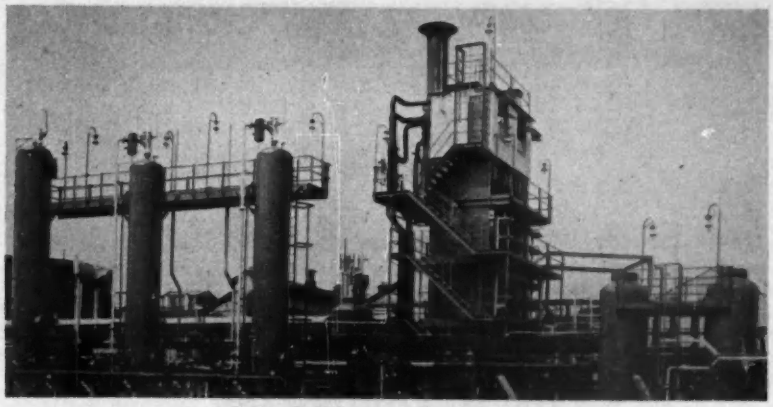


External process line installation erected on gantry by UD Engineering at the works of British Geon

p.v.c. factory of British Geon Ltd., Sully, near Barry, South Wales, where many of the operations, both purification and synthesis, take place at low temperatures.

Toxicological Conference

A toxicological conference between the UK, US and Canada has been held at the Ministry of Supply Establishment at Porton from 9 to 20 September. It was the twelfth of such conferences. Representatives of the three countries have held technical discussions on research and development programmes and other activities of mutual interest in the toxicological defence field.



Power Gas/Hercules reforming plant

First UK Plant for Benfield Hot Potassium Carbonate Process

THE chemical plant division of the *Power-Gas Corporation, Ltd.*, Stockton-on-Tees, has a number of plants in hand, under construction and completed during the year employing the Krystal process. These include a 900 tons per day plant for the production of ammonium sulphate in Italy and plants of 150 tons per day in Germany, Austria and Pakistan. One plant for the production of thorium nitrate, which has been installed in France was designed and set to work by the division, and in this country contracts have been gained for two other plants for the production of sodium chloride and two for the production of sodium sulphate and magnesium sulphate respectively.

The division is acting as main contractors in connection with a substantial extension of an ammonia synthesis gas plant. This plant will be the first in this country to use the Benfield hot potassium carbonate process plant for removal of carbon dioxide and hydrogen sulphide from synthesis gas under pressure designed and supplied by the division.

High Purity Hydrogen

Following the installation of the first plant of its kind in this country using LPG to produce high purity hydrogen, two Power Gas/Hercules plants are nearing completion using propane and butane feedstocks respectively.

Other plants handled by the division include processes employing amine absorption at installations in the UK, Belgium and East Africa.

Two Pease-Anthony scrubbers have been installed at Dounreay by this division. One is similar to those previously supplied to Sellafield and Harwell and is for the treatment of gases from a furnace calcining materials which may be radioactive. The second is to be used to remove sodium oxide fumes which may be formed during the removal of sodium from pieces of equipment in a decontamination booth.

The most recent addition to the range of processes which the division can offer for producing synthesis gas is the Texaco partial oxidation process which will produce carbon monoxide and hydrogen from a wide range of feedstocks including heavy oils, refinery gases and natural gas. The process is normally operated at a pressure of about 350 p.s.i.g. but operating conditions can be varied to suit particular applications.

Purification. Conversion of carbon monoxide to produce hydrogen by the shift reaction,

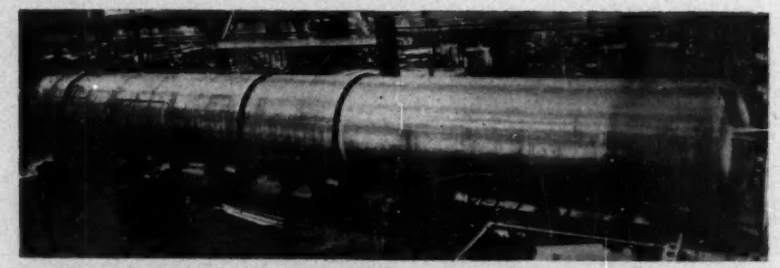
$$CO + H_2O \rightleftharpoons H_2 + CO_2$$

is carried out at pressure using a sulphur resistant catalyst. The number of conversion stages depends on the percentage of carbon monoxide to be converted, and condensate is injected between the stages of conversion to cool the gases and provide the excess steam necessary to ensure continuation of the shift reaction.

To remove carbon dioxide from the gas, hot potassium carbonate, monoethanolamine (M.L.A.) or water wash absorption/desorption processes either alone or combined are adopted, the method chosen depending on the economics of each particular case.

Carbon monoxide and final carbon dioxide removal is achieved by liquid nitrogen wash or copper liquor absorption. The liquid nitrogen wash process is particularly suitable for ammonia synthesis gas production, since an air fractionation plant producing pure oxygen for the Texaco gasification step and nitrogen for the synthesis gas is an integral part of the factory installation. To reduce the carbon dioxide content of the gas to acceptable limits for nitrogen wash an alkali wash is employed. The cost of utilities and chemicals for these processes affects the choice of the final purification step.

News of Plant Projects



Aluminium extraction column under construction by APV. Measuring 80 ft. by 9ft. diameter, it is the largest aluminium vessel ever constructed in the UK

SPECIALISED CHEMICAL PLANT IN ALUMINIUM

FABRICATION of large scale plant in aluminium is a comparatively new development, but demand is rapidly increasing from the chemical, petroleum and nuclear energy fields. A recent and unusual project carried out jointly by the chemical and industrial engineering divisions of the APV Co. Ltd., Crawley, has been the designing and fabrication of plant for the distillation of hydrogen peroxide.

Vapour/liquid equilibrium data for the system was first calculated by Scatchard and Kavanagh (*J. Amer. Chem. Soc.* 1956, **74**, 3715). It was found, however, that graphical extrapolation of this data for the purposes of theoretical design calculation could lead to considerable inaccuracy

6 ft. 6 in. APV West plate in pure aluminium for the distillation of hydrogen peroxide

and it was therefore necessary to make a further extensive study of the system in the company's laboratories before accurate theoretical calculations could be made. Moreover, the unusual nature of the separation, coupled with the extremely high vapour/liquid ratio entailed, precluded the conventional packed 'yardstick' column as a means of testing theoretical design.

This problem was finally resolved by the construction of miniature APV West distillation plates which were incorporated into a glass column and were successfully used for continuous distillation experiments at 40 mms. Hg. absolute pressure. Under these conditions, the West plate was shown to have an efficiency of 57-60 per cent and full scale plant calculations were made on this basis.

Since hydrogen peroxide decomposes readily in the presence of heavy metals, pure aluminium was chosen as the construction material. The fabrication of the full-scale 6 ft. 6 in. diameter column and plates, to the design of the chemical engineering division, was carried out at the Crawley works, where a further five vessels for the same project were also constructed. These included an 80 ft. long by 9 ft. diameter extraction column, claimed to be the largest aluminium vessel ever constructed in the UK. The problems of fabrication lay in the thickness of the metal (as much as 1¼ in. in some instances) and the necessity for weld structure to be completely homogeneous with that of the parent metal.

Among other work, APV have, after investigation and use of liquid metals as heat transfer media for nuclear engineering duties, carried out extensive research into the adaptation of circuits for a variety of applications.

Circuits have been developed for a number of specific duties, including: Heat removal of phthalic anhydride fixed bed converters; synthetic resin kettle heating and cooling; experimental laboratory high temperature heating duties; gas turbine gas to air heat exchanger.

The circuits concerned use either sodium or sodium/potassium alloys. These metals, which cover temperature ranges normally associated with steam and organic compounds, can operate at temperatures up to 750°C and are remarkably quiescent in circuit.

Several thousand hours of service have been achieved in APV experimental loops and have shown there is no deterioration of plant items or risk of reaction, within the circuit, between the Na/NaK and other materials.

The company's chemical engineering division has developed a novel effluent treatment process involving liquid/liquid extraction and distillation under vacuum and pressure for complete removal of the phenols and formaldehyde. The process was tested on a pilot plant scale in a London resin factory, and was approved by a London joint sewage board in 1956.

A full-scale plant is now being installed which will, in this particular instance, recover for re-use over 50 tons of phenol per year. Formaldehyde and methanol will be removed as a concentrated solution containing only 40 per cent of water. Effluent from the plant will have an oxygen absorption of less than 1,000 p.p.m. for a steam consumption of 10-15 lb. per gallon.

Activities of British Oxygen Linde

A RECENT review of contracts placed in the past few months for tonnage oxygen plants reveals interesting details of the activities of *British Oxygen Linde Co. Ltd.* who have received export orders for tonnage oxygen/nitrogen installations worth over £2½ million.

Two recent orders are for tonnage plants to serve the Indian iron and steel works being built at Durgapur and Rourkela, each of one million ingot tons a year capacity. The largest is for the German-built steel works at Rourkela where steel-making is based on the oxygen-steel process. The British Oxygen Linde Co. plant will comprise three units each producing 100 tons a day of oxygen of a purity of 99.5 per cent.

At Durgapur, where the British-built steel works is based essentially on the open-hearth process, oxygen requirements will be lower and the British Oxygen Linde plant will comprise two units each of 50-tons a day capacity.

In accordance with the Indian Government policy to install fertiliser plants alongside new integrated iron and steel works to utilise the hydrogen from the coke oven gas and the nitrogen from the tonnage plants, both British Oxygen Linde installations are required to produce pure nitrogen also. At Rourkela only a relatively small proportion of the total available nitrogen will be required and British Oxygen Linde plant will be designed on the Linde-Frankl (low pressure) principle whereby the air is cooled by heat exchange in regenerators. This design is particularly suitable and economical for the production of the requisite quantities of oxygen and nitrogen. The plant at Durgapur will operate on the medium pressure principle, under which the air is compressed initially to about 11 atmospheres (compared with five to six atmospheres in the Linde-Frankl process) and is purified chemically.

A further order, worth some £800,000, is for a plant with a combined daily output of 275-tons of oxygen and 285-tons of nitrogen to be erected at Modderfontein for African Explosives and Chemical Industries Ltd. It is to be used to extend capacity for producing ammonia by the synthesis process, involving use of oxygen gasification for hydrogen production.

Of the two home orders nearing completion, that at Shell Haven is to supply oxygen and nitrogen for ammonia manufacture. The other, for Petrochemicals Ltd. at Partington, will also supply both gases, the oxygen to be used for the direct oxidation of ethylene to ethylene oxide.

USES OF NEWER METALS IN CHEMICAL PROCESSING

Materials of Construction

THE effects of nuclear energy have been wide but probably in no field have they been so marked as in the field of metals. Metals which a decade or so were laboratory rarities are now being produced on scales hitherto unknown. Perhaps what is more astonishing, the demand for the newer metals or for new uses is considerable.

While atomic projects are absorbing considerable quantities of zirconium, beryllium, hafnium, columbium, titanium, tantalum, industry generally, is now also interested. In the chemical industry, in particular, interest has not only been confined to producing these metals in quantity and in high states of purity but has encouraged their use as materials of construction in chemical plant and equipment.

Developments in the nuclear field have brought into particular prominence zirconium, hafnium, beryllium and columbium.

Zirconium production in the US last year was about 600,000 lb. New plant now under construction will, when in operation, increase the output to some 6 million lb. annually and by 1960, the output may reach 10 million lb.

The pure metal combines neutron transparency, corrosion resistance and high temperature strength. It has proved an ideal material for structural uses in reactor cores or for cladding uranium fuel elements.

Unfortunately zirconium is difficult to isolate in ductile form. However, the technology of producing ductile titanium having been developed, this has been applied to zirconium manufacture with satisfactory results.

Corrosion Resistance

Promotion for non-nuclear uses of the metal is now being undertaken where its valuable anticorrosive property will prove of value. Zirconium's resistance to hydrochloric acid and to most chlorides is exceptional. It is also resistant to attack by alkali solutions and has a high resistance to fused alkalis. At room temperature the metal resists attack by sulphuric acid in most concentrations, by nitric acid in all concentrations, and by most organic acids. In Europe, the metal is already in use in spinnerets for rayon, because of its high resistance. Predictions are that parts employing zirconium will, within the next five years, cost less than twice as much as the same part in stainless steel.

Various new applications have been found for zirconium. The linear expansion coefficient of zirconium is of the right order of magnitude (in the range 50 to 1,000 x 10^{-7} cm./cm./°C) to permit sealing to standard glasses to give good seals with low residual stresses. Very brief flame-sealing periods only are required as zirconium reacts with atmospheric gases, with resulting changes in its expansion characteristics.

Zirconium has been used as a drier catalyst in special electron tubes, as a vessel for the preparation of melamine, and as a cladding material for uranium.

Construction of a zirconium pilot plant by the US Bureau of Mines where it was under attack by hydrochloric acid, showed that it rivalled Hastalloy. Production apparatus which has utilised zirconium includes a zirconium-lined tank, a basket strainer, a steam-jet exhauster, a high speed agitator, a pH electrode assembly, fan wheels, valves, mechanical seals, pulse column plates, pipe fittings and pump parts. In caustic fusions, the expected life was 25 fusions compared to four or five for platinum.

As zirconium is almost as strong as steel and much lighter, is chemically inert, a good heat conductor, has a high melting point and a high specific gravity, it has proved to be an outstandingly good refractory. Zirconium refractories have proved valuable in aluminium melting equipment as they are not melted by aluminium. Stabilised zirconium can withstand temperatures of 2,535°C and at temperatures over 1,500°C, it is an excellent electrical conductor. These properties have recommended its use for insulating resistance furnaces or high-frequency inductors.

The outlook for zirconium is bright, but an obstacle to its commercial use in quantity is price. Notable reductions have occured recently and when an economic continuous process is available for producing the metal a wide market will be available for it.

Hafnium Developments

Hafnium is usually separated as by-products from zirconium ore in the process for producing pure zirconium. Hafnium has also been found to be a good material for nuclear shielding and for atomic reactor control rods. Its resistance to corrosion and mechanical properties are comparable to zirconium, and it also has a high thermal conductivity.

The US Bureau of Mines is now developing a modified form of Kroll titanium and zirconium production process which is stated to produce hafnium sponge of a considerably higher purity than that obtained from the more usual pressure reduction production method. Sodium and magnesium are used to reduce the hafnium tetrachloride to hafnium sponge. With this reaction mixture, lower temperatures than would otherwise be the case are possible. Also impurities picked up from the crucible container are said to be reduced.

Experimental equipment is being redesigned so that batches of about 200 lb. of pure sponge can be produced.

Beryllium. World production of beryl, the only commercial-source mineral of beryllium reached a new record of 12,500 short tons in 1956, 40 per cent higher than the previous record in 1955. This high production is due to the demand for pure beryllium metal in nuclear energy projects. Indeed, well over 200,000 lb. are to be produced this year in the US, with half the amount destined for industry.

A notable property of beryllium is its lightness in weight (specific gravity is 1.85). It also has a relatively high melting point (2,340°F), high strength at elevated temperatures, and, for nuclear applications, low neutron cross-section.

Non-nuclear uses suggested for beryllium are in aircraft structures, as the parts would weigh half as much as those of aluminium. Beryllium's structural value is limited by the low ductility of the metal. It is used in large quantities (up to 90 per cent of beryllium consumed) as a hardening agent in alloys, mostly copper. Addition of 2.5 per cent beryllium to copper produces an alloy which, after heat treatment, is six times as strong as pure copper.

Such an alloy is used for parts subject to abnormal wear, and in springs for instruments, gauges, etc.

Columbium

Columbium. Occurring in nature with tantalum is columbium. It is similar in some respects but very different in others, and while tantalum and tungsten are suitable by virtue of their strength, their high densities have proved to be a disadvantage in many applications. Alloying has proved difficult, and alloy brittleness is encountered with tungsten. It is then that columbium proves suitable.

Density of columbium is about the same as nickel, and it can be suitably alloyed with several metals without brittleness. Oxidation rate is approximately 1/20 that of molybdenum; and the oxide is adherent and non-volatile.

Columbium was first used commercially in 1930, when it was found that addition of 10 times as much columbium as carbon in stainless steel (18-8) acted as a carbide stabiliser, thus overcoming intergranular corrosion. Improvement was also obtained in steels containing two to 16 per cent chromium. Due to restrictions in columbium supplies in the second world war, ferrocolumbium-tantalum was substituted.

Today it appears that producers of stabilised stainless steels favour the columbium variety over the titanium-stabilised and long carbon steels. In the future, usage of columbium in quantity is likely to be in alloys, either as a base for alloys or as an ingredient in alloys of other base metals, for its improvement

of high temperature properties of steels.

Substantial quantities of this metal appear to be used in experimental thermal reactors such as the boiling-water type at Argonne National Laboratory. The value of columbium in nuclear energy projects is difficult to judge owing to lack of information, but it is known to be suitable for cladding cores of fast reactors and for alloying with uranium to make fuel elements, presumably because of its superior heat and corrosion resistance. However, non-nuclear markets for columbium are being sought. Aircraft jet engines, which can utilise columbium's resistance to high temperatures, have been suggested, but no doubt the metal will find applications in the chemical industry when cost factors are considered realistic.

Value of Tantalum

Tantalum. It has been said of tantalum that it is the 'most nearly perfect' material of construction. Not only is it corrosion-resisting but it is acid-proof. Even at high concentrations and boiling temperatures it is completely inert to most acids.

Tantalum has strength; it is an excellent heat conductor and it is not affected by thermal shock. It also has uniform chemical properties. Density of the metal is 16.6, about twice that of steel, and its melting point is 3,000°C (5,432°F). Because of its acid-proof properties tantalum has been used as a material of construction in the chemical industry since about 1930. It is, like glass, immune to attack by almost all acids except hydrofluoric acid. Thus the metal can be used in place of glass when transfer from glass equipment to plant is necessary.

Tantalum is also resistant to reaction with the 'liquid' metals, e.g., bismuth, lithium, sodium or sodium-potassium alloys at temperatures to 900°C and gallium at temperatures to 450°C. Hence its possibilities as a construction material for nuclear reactor systems.

Weldability, ductility and good strength of tantalum with its properties akin to those of steel, permit its fabrication into various required forms and shapes. Because of its excellent heat transfer properties, it has found wide application in the chemistry industry. Use of tantalum has eliminated metal contamination of products. Ammonium nitrate manufacture, for instance, has been improved indirectly through the use of tantalum equipment. Tantalum also finds a wide usage in heat transfer equipment and several kinds of heat exchangers are built of the metal. Very new are plate heaters made of tantalum. Inherently of lower cost than tubular units, these plate heaters offer high surface-to-volume ratio, ease of handling and cleanjng and high heat transfer coefficients obtained with tantalum heaters.

Expanded sheets of the metal are now being produced in a thickness range from 0.003 to 0.075 inch and in widths up to 54 inch. A wide variety of standard widths, mesh dimensions, and number of meshes per inch are practical. Weldjng of smaller widths together will give any desired size of sheet.

Expanded sheets are finding a use as screens for chemical equipment exposed to acidic attack, as support screens for retaining packing in towers, supports for glass and synthetic fibre filter cloths used in filters and centrjfuges and anode baskets used in electroplating baths. It is even suggested that as platinum can be plated on expanded tantalum sheet, as a thin coating, such screens could be useful as catalyst screens and as anodes for electrolytic cells.

Molybdenum. Interest in molybdenum as a heat-resistant material of construction has been maintained. Investigations have involved better mechanical working operations in order to produce material which is reasonably strong and ductile, and efforts have been made to devise suitable protective coatings for high temperature oxidative resistance. A significent advance here has been the discovery of the arc-casting method of producing ingots without limitation and the development of new molybdenum—base alloys. These alloys contain either columbium, titanium, vanadium or tungsten. Such alloys have exceptional strength above 1,600°F. and it is hoped that these may overcome the heat barrier. Unfortunately, however, when molybdenum gets hot in an atmosphere of air or oxygen it burns. Intensive research is being carried out to find suitable protective coatings for the metal. Such protective coatings include aluminium, silicon or zirconium being deposited on the metal by halide decomposition in hydrogen, or a layer of silicon or zirconium can be first vapour deposited followed by reaction with another element.

Use in Steel

At the present time in the steel industry, the leading consumer of molybdenum, quite small quantities of the metal go a long way, common additions being of the order of 0.1 to 0.5 per cent in alloy steels containing chromium and nickel. High speed steels, however, take up to 6 per cent. The new alloys mentioned above have growing industrial application as electrodes, piercing points for seamless tubing and an auxilliary equipment for glass melting furnaces.

Titanium. Although titanium cannot be described as the perfect metal, it does have numerous desirable properties, particularly when suitably alloyed. For the chemical process industry, titanium, even at today's price is one of the most economical materials of construction and as its price is reduced, a heavy demand is to be expected from the chemical process field and allied industries.

The reason for this very bright outlook is the metal's remarkable corrosion resistance particularly to chemical attack. This resistance is usually considered to be due to the formation of a chemically stable and protective oxide film on exposure to air. In many environments it is superior to stainless steel. Particularly noteworthy is its excellent resistance to corrosion in sea water, moist chlorine, metallic chlorides, bleaching solutions. In many ways its behaviour is comparable with that of the platinum group of metals.

Under certain (i.e. oxidising) conditions it is resistant to hydrochloric, nitric and sulphuric acids. Red fuming nitric acid, however, may on contact with titanium or titanium alloys initiate a violent pyrophoric reaction. Otherwise the metal has a useful range of applications in nitric acid at elevated temperatures and pressures. At 166°C. (330°F.) titanium shows a corrosion rate of 5 to 10 ml. per year (0.005 to 0.010 in. per year) in 65 per cent nitric acid—a range where stainless steels are rapidly attacked.

At ordinary temperatures titanium is covered with a protective film which keeps it inert. At high temperatures, this film dissolves so that the metal reacts rapidly with all known refractories. Oxygen and nitrogen introduced during melting on extraction will embrittle the metal completely, making it commercially useless. Prevention of such contamination is the reason for the metal's high cost, for processing has to be carried out in high vacuum or in an inert atmosphere containing argon, or similar inert gas.

Alloying Titanium

Titanium weighs only 56 per cent as much as steel, but its ultimate tensile strength of 25 to 55 tons/sq. in. can be raised to 70 to 85 tons/sq. in. by alloying Strength of the metal, however, decreases with increase in temperature and although it retains useful properties compared with those of other light metals at the higher temperatures its effective limit is about 500°C. Improvements in alloying may overcome this defect and particularly that of oxidation.

Heat transfer rate for titanium is about the same as austenitic stainless steels and far better than most non-metallic substances. This, combined with its corrosion resistance is leading to it replacing plastics, glass and other such materials in chemical processing.

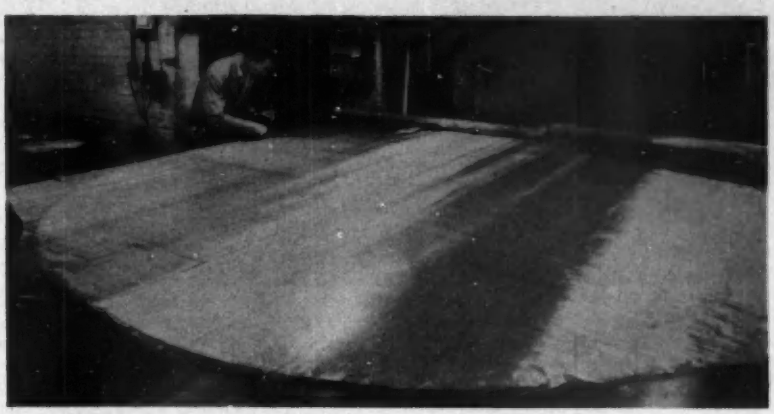
A contributing factor to the rapid expansion of titanium has been its fabrication with equipment designed for stainless steels. Machining, forming and welding can be performed with little difficulty when allowance is made for the metal's special characteristics.

Many potential applications of titanium in the chemical and engineering trades await development. The metal is already being used in chemical plant where, under severely corrosive conditions, high strengths at moderate temperatures are needed. Thus a number of titanium reactors and autoclaves are in service in nitric acid-organic mixtures, under conditions of temperature and pressure where life of stainless steel equipment has been limited. Plant designers are also interested in titanium for plant intended to run at high rotational speeds, where high strength/weight ratio of titanium can lead to a reduction of centrifugal stress and where high tensile steel cannot be used because of its magnetic properties.

The price of titanium has already been reduced in recent months and as production and demand increase the price will no doubt be further reduced. It is firmly believed that in the next five to 10 years, demand for titanium in chemical processing will surpass the demand from the aircraft industry.

Noble Metals in Chemical Engineering

Platinum, Palladium, and Silver



Cutting an 8-ft. diameter platinum catalyst gauze to template preparatory to welding to the edge

A QUARTER of a century ago consumption of the noble metals was mainly confined to the jewellery and decorative trades. Since then, however, the demand from these sources has been completely overshadowed by the increasing requirements of industry, and the process industries in particular now rank as the largest consumers of the noble metals. In the chemical industry the uses of these metals, notably of platinum, palladium and silver, fall into two main categories. Because of their resistance to oxidation and chemical attack and the ease with which they may be fabricated, they are often the most suitable materials for the construction of plant subject to highly corrosive conditions, while their remarkable catalytic activity is employed in many reactions of commercial importance.

Justification for Use

Use of noble metals as constructional materials has been restricted in the past because of their high initial cost, and much attention has been given to the development of base metal alloys in an attempt to obtain similar corrosion-resisting properties. However, where the high rate of corrosion of base metal precludes its use or where the contamination introduced would have an adverse effect on the purity of the product, the employment of noble metals is fully justified, and in these cases the cost is largely offset by the eventual recovery value of the metal. Loss of metal is almost negligible during service and when the plant or process is finally taken out of production the large proportion of initial cost bound up in the intrinsic value of the metal may be recovered.

Uses in chemical plant: Silver is the most widely used of the noble metals for plant construction, as it is resistant to a wide range of corrosive fluids. In most cases this resistance to attack depends on its high positive electropotential, although where halogens are present it is due to the formation of an impervious halide film which builds up on the surface.

Examples of the use of silver equipment where products are sensitive to contamination are in the preparation of pure castings of caustic soda and potash, and in the manufacture of photographic emulsions, where base metal contamination would lead to fogging on subsequent processing. However, most silver plant is employed for reactions where base metals would give an uneconomically short life. Examples of such reactions are the distillation and condensation of formic and acetic acids and their homologues, halogenation and reactions involving halogen compounds, esterification and high pressure synthesis.

While there is only limited scope for reaction vessels of solid silver, the applications of solid drawn silver tubes are more numerous. Thin-walled tubes are employed in structures subject to low unit stresses, such as heat exchangers, condenser tubes and cooling coils.

More usual is the use of a relatively thin liner of silver reinforced by a base metal shell. This shell may be of copper, nickel or mild steel depending on the mechanical and thermal properties required. Liners are fabricated from sheet, fusion-welded at the seams with filler rod of the same high purity, and they may be bonded or loose fitting. Loose liners are used mainly for thick-walled vessels such as high pressure autoclaves. They are made to be a press fit, and provided build-up of pressure between liner and vessel is avoided they are found to be perfectly satisfactory—their only disadvantage being a slight loss in thermal transmission.

Bonded liners

Bonded liners are more generally employed and copper or mild steel vessels of capacities up to 250 gallons may be lined with sheet silver about $^1/_{32}$ inch thick, metallically bonded throughout with silver solder. There is no danger of lift or creep, such structures may be worked under full vacuum and high rates of thermal transmission are possible. Complete reaction and distillation systems may be constructed with silver surfaces throughout, and it is possible to line many existing vessels not specifically designed for this purpose.

Other methods of construction include fabrication from silver-clad mild steel for the heavier types of chemical plant and electrodeposition for the protection of equipment of complex shape.

By comparison, platinum is less used for constructional purposes for although it is the most generally corrosion-resistant material available, its initial cost is far greater. However, small pressure vessels are fabricated from platinum sheet and larger equipment from platinum-clad nickel or copper for service in extremely severe conditions as, for instance, the pyrolysis of organic fluorine compounds at high temperatures. Platinum equipment is also used for processes in which the purity of the end product is of prime importance—for example, the manufacture of optical glasses. Large platinum stills were at one time fairly extensively used for the concentration of sulphuric acid, and although their use has declined in recent years the advent of platinum-clad nickel as a constructional material may well see their return.

By
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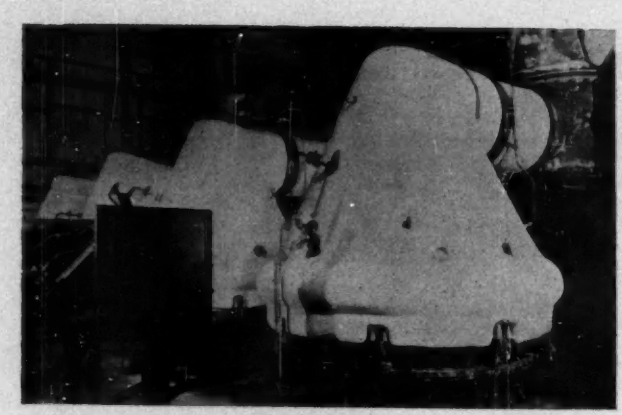
Substitute for Platinum

Where conditions permit, palladium is used as a substitute for platinum because of its lower cost; as a rough guide about five palladium components may be made for the cost of one platinum component. Palladium is resistant to a wide range of corrosive fluids and being easily fabricated may conveniently be used for lining reaction vessels and producing such accessories as joint rings and diaphragms.

Gold finds limited applications as a plant liner in the form of either thin sheet or electrodeposit but platinum is usually preferred because of its better mechanical properties.

Bursting discs: Bursting discs in various metals are being increasingly employed for the protection of chemical plant operating under pressure. In corrosive conditions there are numerous advantages to be gained from their use. They are simple to install and maintain and have properties such that errors in assembly or accidental damage tend to cause them to burst at a lower pressure than that for which they were designed: they cannot in any circumstances be made to withstand any greater pressure. Their small inertia enables them to open to full bore in a few milliseconds and there is complete absence of leakage until the specified rupturing pressure is reached.



Two-metre diameter Bamag-type ammonia oxidation burners at the Royal Ordnance Factory, Bridgwater. Each is fitted with three 5 per cent rhodium-platinum gauzes

Bursting discs usually take the form of a ductile disc of metal mounted in a machined holder. The disc must be completely resistant to ambient corrosion and have properties which are reproducible from batch to batch, and of the noble metals silver, gold, palladium and platinum are variously used according to the severity of the conditions and the working temperature.

Other uses of the noble metals: Rhodium-platinum wire, because of its high melting point and resistance to oxidation, is much used in resistance-wound laboratory furnaces for the production of high temperatures, and there is available a wide range of standard platinum laboratory apparatus. Rhodium-platinum alloy thermocouples provide an accurate and convenient method of measuring temperatures up to 1,700°C., while the pallador thermocouple (palladium-gold: iridium-platinum) gives a higher e.m.f. for the measurement of lower temperatures. Platinum of particularly high purity is also used in resistance thermometry.

Insoluble Anodes

Insoluble anodes are required for certain electrochemical processes, for instance, the manufacture of persulphates, perchlorates and bromates, and various designs have been evolved to provide as large a surface area as possible per unit weight of platinum. One of the most successful of these is the sheathed—rod electrode—a thin-walled platinum tube drawn to be a press fit over a copper rod. These tubes have a wall thickness of about 0.002 inch and very careful control of the drawing conditions is necessary to ensure freedom from pin-holes.

One of the characteristic properties of palladium is its ability to absorb hydrogen, hence its use as a diffusion barrier in chemical plant for the production of small quantities of very pure hydrogen and deuterium. A palladium membrane of tubular shape is usually employed for such purposes and similar apparatus may be used as a flow-regulating device, the absorption varying with temperature.

Noble metal catalysts: The catalytic activity of platinum, palladium and silver has been known for many years and these metals were among the first materials to be used industrially as catalysts. In the past few years there has been a remarkable expansion in their employment both in quantity and variety. The re-forming of petroleum over a dispersed platinum catalyst has come to the fore only recently. Hydrogen and a vapourised petroleum fraction of narrow boiling range are pre-heated and passed under pressure through a catalyst containing about 0.5 per cent platinum, usually on an alumina base. The reactions that take place are numerous and complex and the product obtained has a considerably enhanced octane rating. Recycling increases this rating still further, and with changes in the operating conditions the product can be made a rich source of aromatic chemicals.

Ammonia Burners

Another reaction of great industrial importance employing platinum catalysts is the oxidation of ammonia to the oxides of nitrogen. The ammonia burners used in the manufacture of nitric acid and in the chamber process for sulphuric acid contain catalyst pads of woven gauze. The gauzes, which may be up to three metres in diameter, are woven from either platinum or rhodium-platinum wire and they are then made up into pads containing anything between four and thirty layers, depending on the operating conditions. Similar catalytic plant has been found suitable for the manufacture of hydrogen cyanide from ammonia and carbon monoxide and is now becoming well established.

Solid silver reaction vessel in a cast-iron jacket fitted with a solid silver vapour pipe and coil

Despite the wide use of vanadium pentoxide there are still a number of contact process plants employing platinum as the active catalyst. The platinum is dispersed on asbestos or some other suitable carrier and has the advantage over vanadium pentoxide of being able to convert a mixture of gases containing a higher ratio of sulphur dioxide to oxygen. Other reactions using platinum catalysts are the hydrogenation of aldehydes and ketones to primary and secondary alcohols, and the production of amines by the hydrogenation of certain nitriles or by the treatment of the corresponding aldehyde or ketone with ammonia and hydrogen. One interesting recent application is in the exchange process for the extraction of heavy water where a platinum-on-charcoal catalyst is used.

Palladium is the most effective of hydrogenation catalysts for both liquid and vapour-phase reactions and it is notably selective both stage-wise and group-wise. An example of this stage-wise selectivity is the production of ethylene from acetylene with a negligible yield of ethane, by hydrogenation at 200°C. over a palladium-on-silica gel catalyst. Palladium-on-alumina catalysts are used for gas purification by catalytic combustion (oxygen may be removed from hydrogen, or vice versa, by conversion into water and subsequent drying). Palladium is also extensively used in organic synthesis, since liquid phase hydrogenation at low temperatures in many instances yields a simple product of high purity. In these reactions the catalyst is usually converted *in situ* into the form known as palladium black.

Silver as a Catalyst

The main use of silver as a catalyst is in the vapour-phase dehydrogenation of methyl and ethyl alcohols to formaldehyde and acetaldehyde. Water vapour, air and an excess of the alcohol vapour are passed either through a thick pad of silver gauzes or over a shallow bed of crystalline silver. The metal must be in an extremely high state of purity to ensure maximum catalytic activity: the crystalline form is produced by electrodeposition and then graded into close grain sizes. Silver is also active in promoting many gaseous-phase oxidations. An example is the oxidation of ethylene direct to ethylene oxide, a method which is now competitive with the alternative process through chlorohydrin.

Future prospects: The other platinum group metals, rhodium, ruthenium, osmium and iridium, have as yet found no catalytic applications of commercial importance. They have been mentioned from time to time in technical publications but there has so far been no large-scale development in their use. However, the continued research into the catalysis of different reactions may well throw new light on their importance to industry.

Meanwhile, the potential uses of silver for plant construction are extending continually and wider applications are being found for silver and palladium catalysts. The output of platinum for catalyst manufacture has shown the greatest increase recently and this overall tendency towards the greater use of the noble metals by the chemical industry seems likely to continue in the future.

APPLICATIONS OF PLASTICS IN CHEMICAL PLANT

Construction and Protective Coatings

By
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PLASTICS are finding increasing use in the chemical plant and ancillary fields. Many notable instances of this were shown at the recent Plastics Exhibition at Olympia and numerous examples have been described in the technical press during recent years. It is of interest to ask why this present position has arisen. The answer is that many plastics materials combine several properties which are of great importance in chemical plant, and moreover not many alternative materials possess such combinations of properties; in fact, it is true to say that some plastics are unique in this respect and can be regarded as materials of construction in their own right. These properties are:

(1) Strength combined with lightness.
(2) Good chemical resistance to a very wide range of acids, alkalis and solvents.
(3) Comparative ease of fabrication and formation to complex shapes.

Although a major application is in the actual construction and fabrication of plant and equipment, considerable use is made of plastics for protective coatings and linings together with their use as a basis for corrosion resistant cements.

Two Groups

As is well known plastics are divided into two main groups, the so-called thermoplastic and thermosetting types; both types have important applications in the chemical plant field. The most important types of thermoplastics are p.v.c. and polythene together with their variations. Both materials are available in a wide variety of forms such as sheet, rod, tube, etc., and both can be moulded, blown, extruded and pressed into quite complex shapes by suitable techniques after heating. In addition, normal machining operations such as cutting, drilling, turning, etc., are readily carried out. It is, however, the availability of welding using a hot gas torch combined with a welding rod of the material which has extended the applications of these two materials.

Polythene, being the more flexible of the two materials, has been used on the whole for smaller plant and equipment such as small tanks, trays, buckets, jugs, metering wheels, air agitation coils and also laboratory equipment. Another important application is in the use of extruded polythene pipes for effluent drainage. Polythene has excellent chemical resistance except to solvents and in general should not be used at temperatures in excess of about 55°C. However, great interest has been aroused by the recent introduction of the so-called 'low pressure' or 'high density' polythenes. These grades are appreciably tougher and less flexible than normal polythenes made by the high pressure polymerisation processes; in addition their temperature limitation is somewhat less. For these reasons greater use is likely to be made of the newer grades in chemical plant, but at present a careful evaluation of their behaviour is in progress. Another interesting development has been in the irradiation of polythene by high voltage X-rays and other sources which produce remarkable changes; the softening point, chemical resistance and mechanical strength all increase, but obviously such treatment is limited to relatively small items of equipment.

Polyvinylchloride (p.v.c.) is the other thermoplastic of major interest in these applications. It is mechanically stronger than polythene and much more rigid, so that larger items of plant can be fabricated. It also has excellent chemical resistance, somewhat better than polythene and has about the same temperature limit of 55°C. P.v.c. has been used successfully in the fabrication of tanks, vessels, absorption towers, ventilation stacks and exhaust ducting of all types and sizes. Smaller scale applications include pumps, pump parts, ventilation and exhaust fans, troughs, trays and dishes. Extruded p.v.c. pipes have also been manufactured, but as p.v.c. has limitations as regards impact resistance the tendency has been to make use of various modifications to produce the 'high impact' resistant grades for the purposes of extruded pipes.

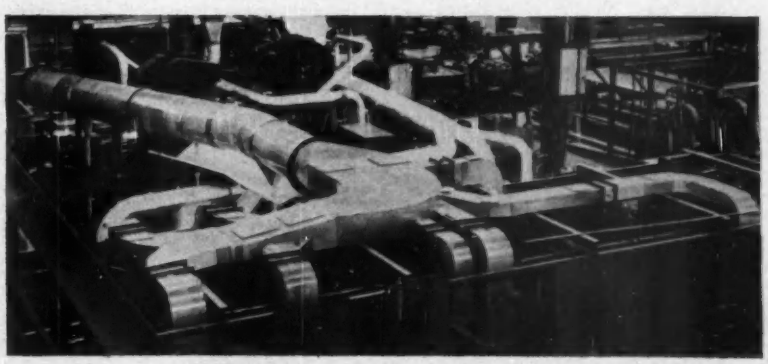
Regarding thermosetting plastics the major interest is at present in the application of the so-called reinforced plastics, that is, combinations of thermosetting resins such as phenol formaldehyde, furane, polyester, or epichlorhydrin with various types of fibrous reinforcement such as asbestos, glass cloth or glass mat. Such combinations provide materials having extremely good mechanical strength including very high impact resistance. The use of phenol formaldehyde resins in conjunction with asbestos filler form the basis of a well-known proprietory product used for the construction of a wide variety of plant such as tanks, vessels, towers and similar equipment. In the case of phenol formaldehyde resins it is necessary to effect a cure at over 100°C. in order to eliminate the water produced by further condensation of the resin; the same procedure is necessary also with furane resins. On the other hand with polyester and epichlorhydrin resins using appropriate curing agents no volatile products are produced during the resin cure and consequently no heating is absolutely necessary, although mild post cure heat treatments are usually given in order to obtain laminates with maximum heat and chemical resistance.

Nevertheless, because of the relative ease with which these two resins can be cured, extensive use has been made of their combinations with glass cloth and glass mat for the fabrication of equipment such as tanks, vessels, covers, ducting, fume extraction and fans. Tanks made from polyester resin laminates have been used for cold and hot water swill tanks in metal descaling and electroplating, bright nickel plating solutions, phosphating solutions, dyeing and bleaching solutions, storage of dilute acids and photographic processing solutions.

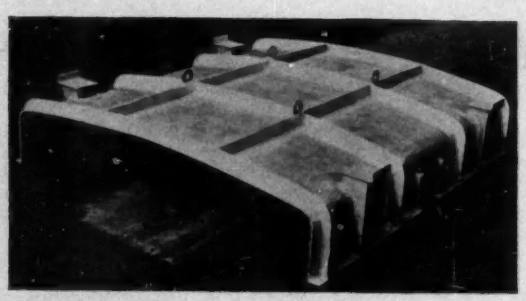
'One-off' Quantities

Most chemical engineering equipment is required in 'one-off' quantities and for this reason the most frequent method of fabrication is that of the 'wet lay-up'. This technique appears very simple, but requires great care and attention to produce good laminates. In essentials, it consists of applying a coat of the resin to a suitable male or female mould, laying on the liquid resin and glass fibre reinforcement and carefully rolling down to ensure adequate welting of the glass fibre reinforcement and also to eliminate any air; this process is repeated until a laminate of suitable thickness has been built up. Finally, after the resin has hardened a post cure is normally applied by stoving at moderate temperatures in an oven.

Laminates prepared from polyester resins have good chemical resistance to most inorganic acids, except oxidising acids,



Exhaust fume ducting from large metal descaling plant, fabricated in rigid p.v.c.



Cover for sulphuric acid descaling tank, fabricated in glass reinforced resin laminate

to some organic acids, to salt solutions and to some solvents; they are not suitable for alkalis except mild and very dilute alkaline solutions. If polyester resins are replaced by epichlorhydrin type resins much higher alkali and also solvent resistance is obtained. Another useful feature of these laminates prepared with either type of resin is temperature resistance. Temperatures appreciably in excess of 100°C. are safe with these materials and for suitable conditions the limits may approach 150°C. for polyester laminates and 200°C. for epichlorhydrin types; these are notable advantages when compared with thermoplastic materials such as polythene and p.v.c.

Resin laminates are also constructional materials of appreciable mechanical strength and as such may be used for the construction of complete items of plant and equipment and are not mere lining or protective coating materials. Moreover, they require no painting or other external treatment. Epichlorhydrin resins are rather expensive and more recent developments consist in the combination of a thin inner laminate of epichlorhydrin resin supported by a thicker polyester resin laminate to provide the necessary mechanical strength. Tanks and vessels are also available using furane resin laminates with polyester resin laminates, thus making available the very good, all round chemical resistance of furane resins, including resistance to most acids, alkalis and solvents.

Pipes and Fittings

Other applications of glass reinforced plastics in the chemical engineering industry include the manufacture of pipes and tubing and various fittings but so far only limited use of these products has been made in Great Britain. This application is likely to be of greater importance in the future.

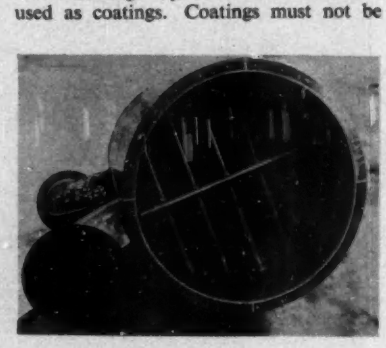
Some of the more specialised plastics are being used for the manufacture of smaller items of equipment such as gaskets, sealing discs, pump parts and even small pumps. These include such materials as polytetrafluoroethylene, polychlorotrifluoroethylene and silicone rubbers. The first two materials are distinguished by exceptionally high chemical resistance and also very good heat resistance; polytetrafluoroethylene being capable of use up to 300°C. Silicone rubbers have appreciably less chemical resistance, especially to solvents but may still be used up to 200°C. Interesting developments are taking place with fluorine polymers which may result in fluorine synthetic elastomeric materials with exceptionally high temperature and chemical resistances.

Plastics have made important contributions to the protective lining and coating fields in chemical plant protection. It is convenient to deal separately with linings and coatings and for this purpose a working differentiation is thickness; linings are usually some 30 mils, or greater, coatings below this figure. It is also often the case that linings are applied in sheet form, usually $\frac{1}{16}$ in. to $\frac{1}{4}$ in. thick. Some of the thermoplastic materials already considered are used for this purpose, notably polythene and p.v.c. With polythene because of its high coefficient thermal expansion and the difficulties of adhesion it is applied normally as a loose lining. It can be applied also by flame spraying and also fluidised sintering, but these techniques are confined normally to relatively small items of equipment.

PVC Linings

In the case of p.v.c. application can be made by a combination of heat and suitable adhesives to provide firmly adherent linings. Such linings have the good chemical resistance of p.v.c., as well as the inherent temperature limitations. Another technique makes use of p.v.c. sheet on the back of which is calendered a sheet of plasticised p.v.c.; the latter material is more readily adhered to metal and other surfaces and also provides a flexible backing to the p.v.c. Plasticised p.v.c. itself is used as a lining material either as such or as an impervious membrane behind bricks or tiles set in corrosion-resistant cements. Some of the synthetic rubbers are used in sheet form for lining purposes; they include Neoprene with good resistances to fats, butyl rubber with improved resistance to oxidising acids, Thiokol with excellent resistance to solvents and some other specialised synthetic rubbers. Recent developments in linings include the use of glass reinforced laminates and in the case of laminates based on polyester and epichlorhydrin resins good adhesion to concrete is available.

A wide range of plastics materials has been used as coatings. Coatings must not be regarded as the mere painting of surfaces, although many are applied by spray and even brush. It has been established that a minimum thickness of 5 mil. is necessary in order to achieve real protection, but frequently this is exceeded and some coatings really pass into the lining field. Quite often, because of the possibility of producing comparatively thin coatings, they are used to prevent contamination of products such as solvents, beverages, foodstuffs, pharmaceuticals, etc., rather than protection of the containing vessel from corrosion. Among the more common coatings are phenol formaldehyde, epichlorhydrin and polyurethane resins. These are usually applied to the cleaned surfaces by spraying, several coats being required and the coating finally stoved at suitable temperatures to provide complete curing of the resin. Frequent use is made of these coatings for treatment of mild steel for the storage, transport and in some cases processing of a wide variety of solvents, oils, fuels and fine chemicals.



Scrubbing tower fabricated in rigid p.v.c.

PTFE Limitation

Originally, great hopes were centred on the use of polytetrafluoroethylene as a coating material because of its exceptional chemical and heat resistance, but good, pin-hole-free coatings have not been achieved as yet; nevertheless, they have been used quite successfully as 'non-stick' coatings. Greater possibilities are provided by polychlorotrifluoroethylene and progress is being made with this material. Other plastics materials which have applications in the coating field include solutions of Neoprene in solvents, vinyl and furane resins.

Another use of plastics having wide applications in chemical plant is as a basis for various types of synthetic resin corrosion-resistant cements. They consist essentially of a synthetic resin of a syrup-like consistency which is mixed with inert fillers such as silica powder, carbon, etc., to give plastic, mortar-like masses which are used much in the same way as normal mortars to set bricks and tiles for vessel and tank linings and the construction of corrosion-resistant floors and masonry.

Curing Agents

Frequently curing agents for the resins are incorporated in the inert fillers or added to the resin prior to mixing with filler. As a basis for these cements several synthetic resins have been used including phenol formaldehyde, furane, epichlorhydrin, polyester and cashew nut shell liquid and provide resistance to a wide range of acids, alkalis and solvents. However, no synthetic resin is available so far which provides resistance to really strong nitric acid solutions.

It will be seen that plastics have many important applications in the chemical plant field; these are rapidly growing and with many interesting developments in hand they will undoubtedly play a major part in solving the many difficult problems of the chemical engineer.

In conclusion the author wishes to thank the directors of Prodorite Ltd. for permission to publish this article and allowing the use of various photographs.

Glass Reinforced Plastics in Chemical Plant

By D. S. Stephens★

GLASS-FIBRE reinforced resins have been on the engineers' lists of materials of construction for several years now. In general their use has proved satisfactory and there is now a body of experience and data, both chemical and physical, upon which design can be based.

Very broadly glass-fibre reinforced resins have the following characteristics:

1. Structures made from them are light in weight in comparison with comparable structures fabricated from competitive materials.
2. Operating surfaces can be made smooth and easily cleaned.
3. Unit construction of quite large and awkwardly shaped structures, is relatively easy.
4. They are freely available.
5. They are priced very competitively.
6. Properly manufactured they have excellent resistance to a very wide range of reagents including many solvents.

However, as in the case of all other materials, glass-fibre reinforced resins have their difficulties, a lack of understanding of which has been behind those failures in use which have occasionally occurred. The reinforced resin industry has grown so rapidly that it has been in some danger of over-reaching its capabilities. This difficulty has been enhanced by a tendency to over-simplification of the manufacturing techniques which have to be applied to produce satisfactory structures, and it is essentjal to take note of the following important points.

1. It is still too readily assumed that precise control during manufacture is not necessary. This is a grave error, and consistently reproduceable results depend upon close control of resins, reinforcements, and conditions of manufacture such as temperature, humjdity, and handling skill.

2. Reinforced resins generally have a low 'E' value. This means that plane sections may lack 'stiffness'. The result of this is that a design which is suitable for, say, sheet metal, cannot necessarily be reproduced in reinforced resins. Load bearing structures, particularly those concerned with fluid loads, require designing with the special characteristics of reinforced resins always in mind.

3. It is often assumed that, in the case of glass-fibre reinforced resins, the glass fibres are jmmune from chemical attack. This is frequently far from the truth as the chemical resistance of glass fibres is, in some cases, substantially inferior to that of glass in its massive state. One of the chief aims of those concerned with the manufacture of chemical plant from glass-fibre reinforced resins must always be the protection of the fibres against chemical attack.

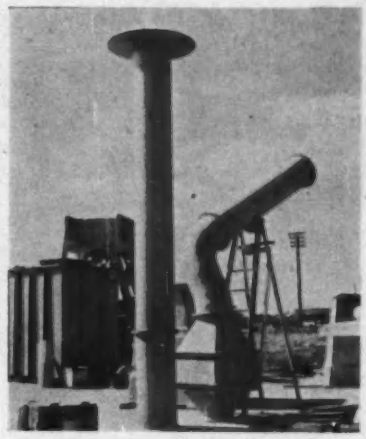
4. Resinous materials, perhaps more than most metals, have a tendency to creep under load. This tendency is obviously reduced when reinforcement, especially fibrous reinforcement, is present. Much work has been done on this subject, but it cannot yet be considered to be fully investigated, and the increasing use of glass-fibre reinforced resins at temperatures of the order of 100°C requjres careful attention to this point.

Bearing in mind the advantages and difficulties associated with glass-fibre reinforced resins, there would appear to be a number of applications, in the chemical industry, for which these properties render them particularly suitable. Some of these are as follows:

Fume ducting. Extraction ducting frequently needs to be made jn special shapes to fit in with the plant requirements. This can easily be arranged if glass-fibre reinforced resins are used with the additional advantages of lightness and corrosion-resistance. Installation is simplified and maintenance reduced.

Pipe-work. Complicated pipe-runs form a part of most chemical factories and the weight which has to be suspended is in many cases very considerable. Glass-fibre reinforced resin pipes have a considerable weight advantage over competitive materials and again can be supplied sujtably corrosion resistant. The question of reinforced resin pumping equipment has been raised, and it is likely that this will soon be a part of any glass-fibre reinforced resin pipe installation.

Suspended vessels. Most large reaction vessels have associated with them a number of smaller subsidiary vessels which are used as holding or measuring vessels. It is frequently convenient to suspend these over or near to the parent vessel to take advantage of gravity feed. Once again the lightness of glass-fibre reinforced resin construction together with its corrosion resistance, offers advantages of jnstallation and freedom from maintenance.



Chemical plant in Resilon indicates the ease with which relatively large structures can be fabricated. (Resilon is the trade name of Mendip (Chemical Engineering) Ltd., by whose courtesy these photographs appear)

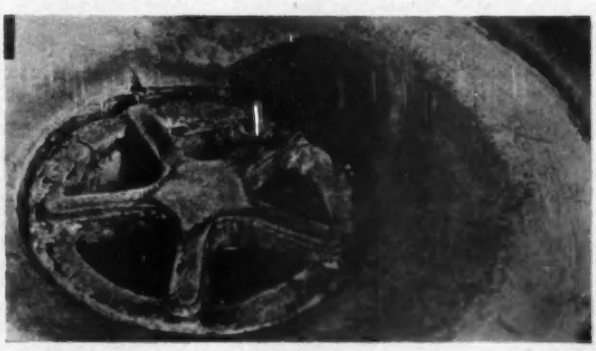
Special structures. Generally in chemical factories the need occasionally rises for special structures, or vessels—the 'one-off' of special dimensions, or for special purposes. In such cases the relatively cheap tooling requirements for glass-fibre reinforced resins, coupled with their ease of fabrication jnto complicated shapes and sections, render them most suitable for this kind of work.

Handling equipment. A large proportion of firms still use batchwise production methods for reasons of economy and flexibility. This means a considerable amount of man-handling in trucks, trays, and transportable containers of one sort or another. The use of glass-fibre reinforced resin components can lead to considerable economy of labour under such circumstances, together with lower maintenance costs in many cases.

Careful thought reveals many other applications which take advantage of one or other of the special properties of glass-fibre reinforced resins. A brief list would be: Effluent tanks; filter press plate and frames; filter-cake trucks; drying stove trays; large transport tanks; charge-hoppers, etc.

No account of the use of glass-fibre reinforced resjns in chemical plant would be complete without reference to the future. Developments can arise in three

(*Continued on page* 508)



This Resilon lining to a large diaphragm pump was accidentally damaged by the mechanical fracture of a pump component. The 1½-in. deep cavity then developed in a matter of hours. Brush marks of the original lining can still be seen on the rest of the lining

★ Chief Technical Manager of Ashdowns Ltd.

★ A MOST convincing reply to those Welshmen who view the advent of the new chemical industry in Glynllifon that is projected by Ashburton Chemicals, Manchester, appears in a recent issue of the *Caernarvon and Denbigh Herald*. Mr. J. L. Roberts, as secretary of the Nantile Valley unemployment movement, says 'We must choose between industries and landscape and remember that a little bit of rock from Cwm Silyn or tree leaves from Glynllifon are not acceptable as payment on the grocer's counter.'

Mr. Roberts ends by quoting the following, with obvious envy, from a national newspaper: 'A spending spree hit Tees-side yesterday when thousands of workers of ICI bought luxury goods after cashing bonus shares. . . . Biggest rush was at TV shops in towns around Wilton and Billingham.'

★ A NEW method of packaging has helped Quickfit and Quartz, Stone, Staffs, makers of interchangeable laboratory glassware, cut their transit breakage figure which has now been reduced to .01 per cent.

Mr. E. L. Harrison, sales director, tells Alembic that this low percentage is due to the recent innovation of using chalk instead of sawdust in the packing of condensers. Chalk has a greater cushioning effect on the coils of the apparatus in transit. It is also more easily cleaned out than sawdust when the equipment reaches its destination.

★ AT ONE TIME waste carbon dioxide was a problem. Now the demand for this gas is such that plants primarily to produce it are a must. Distillers Co. Ltd., who until recently had three plants operating, now have a fourth generating plant producing primary carbon dioxide (see p. 492). This was completed on 31 July last and went into operation last month.

Alembic learns that this new plant has been built by four nations. Distillers provided the basic design, and plant and equipment has been obtained from Germany, Switzerland and Holland.

Another point of interest about this plant is the speed with which it has been built and come into operation. The site on which it stands was unreclaimed last October. This carbon dioxide unit has been built next to older plant of Distillers' Dagenham fermentation unit. The company, it is learned, are to replace gradually all the older plant and equipment there thus modernising the whole site.

Large quantities of carbon dioxide are being used in aerated drinks, engineering works are using more and there is an increasing demand for it as a refrigerant in tool lathing and in machining for heat-resistant alloys for jet engines. Recent work by the British Welding Research Association has successfully developed the use of carbon dioxide instead of argon in welding. Nuclear reactors such as that at Calder Hall use carbon dioxide as coolant. It was thought that once the reactor was filled up with its supply of liquid gas, it would not require more, but it has been found in practice that the carbon dioxide leaks away, and this loss has to be made good.

★ SELDOM has an ICI product won such quick favour as Terylene. The success of this polyester fibre with the public has been much greater than anticipated by the company's most optimistic market surveyors. Hence the big increased planned in capacity. Events will doubtless prove the dropping of Ardil acrylic fibre in favour of Terylene a wise one for ICI. Competition is intensifying in the synthetic and man-made fibre field and it is obviously a good policy to concentrate on your best product. The pace will quicken when Chemstrand, and Du Pont open their new plants in Northern Ireland and when Courtaulds have their new Fibro plant in full operation at Grimsby.

Meanwhile Alembic congratulates ICI on their generous plans for handling workers at their Ardil plant in Dumfries. One Union representative has gone on record as saying 'General opinion in the factory was that no other industry in the country would have given their workers such consideration.' Plans include transfers to Wilton Works, and compensation payments.

★ STILL on the subject of acrylic fibres, Alembic learns that the Chemstrand Corporation of the US, claims to have produced a dyeing process for blends of wool and Acrilan which 'promise to set new standards in man-made fibre wool blend dyeing. The method, as yet undisclosed, produces dyeing times similar to those for 100 per cent wool.

Mr. Walter H. Hindle, the company's associate director of research and development, told the members attending the symposium of the Society of Dyers and Colourists (see page 519) that even more improvements in acrylics would be forthcoming. He said that not even the most enthusiastic manufacturers of acrylic fibres believed that their current product had reached the ultimate point for all purposes. Chemstrand believe that great new and additional markets can be developed for Acrilan because of its flexible base by the engineering of specific fibre properties for specific end uses.

★ AWARDED one of the American Chemical Society's awards for 1958 is Mr. duBois Eastman, director of Texaco's Montebello Calif., laboratories. Mr. Eastman has been responsible for the development of the company's synthesis gas generation process for manufacturing hydrogen, which has been, or is being, installed under licence in 25 chemical plants in North and South America, Europe and Asia.

Investments in these facilities will exceed $300 million (approximately £108 million) and the ammonia capacity of the plants will be 1,642,500 tons a year. Hydrogen from the process is now going mainly into ammonia.

But, say Texaco, the future of the process is even more promising, for cheap synthesis gas or hydrogen, by a 'process more economical than any so far developed, is widely applicable to many industries'. In oil where the number of hydrogenation units is increasing rapidly, it will eventually be a key to the production of synthetic fuels. Uses are also seen in steel making and for producing town gas.

The process is described as fundamentally a new instrument for chemical synthesis. Working interchangeably on a vast range of carbonaceous materials, it frees synthesis plants from many economic and geographical limitations. Where natural gas or coal is not readily available, it works economically on easily transportable and storable oil products.

★ CHEMICALS have been applied to trees for one reason or another for more than 200 years—to trace the flow of sap, to colour or preserve the wood, to control diseases and to dispose of unwanted trees. Not until recently, however, was the idea of killing trees with a chemical considered important in logging and pulpwood cutting.

Alembic was particularly interested, therefore, to learn of the rapidly widening application of the use of sodium arsenate in the Canadian lumber industry. This compound serves a triple role, killing trees, providing an ingenious new way of more easily removing the bark, and pre-seasoning the trees while still standing.

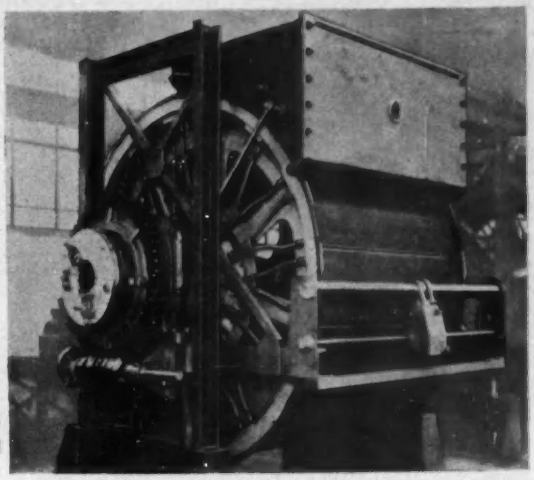
Howard Smith Paper Mills, with the co-operation of Canadian Industries Ltd., carried out extensive trials over the three summers starting from 1954. First the outer and inner barks are removed and the chemical painted on the cambium. It mixes with the sap and enters the cells of the cambium which soon collapse and die.

The whole operation must be started and finished during the short six or seven-week spell when the sap is flowing freely. Left standing for 18 months or so, the tree ultimately weighs less than rough wood cut green and seasoned over the same period; hence a saving in freight costs.

Alembic

Recent Developments in Continuous Filtration Equipment

By
G. D. Kelsey, B.Sc.



Topfeed filter. Photos by courtesy of International Combustion Ltd.

THE development of new processes and the introduction of new products has resulted in the demand for continuous operating process equipment. Economics of production dictate that production costs be kept to a minimum which means that manpower must be used to the fullest advantage. It is for these reasons that unit processes are, where possible, introduced on a continuous basis. The unit process of filtration is one which has called for continuity of operation and new techniques have been devised to execute this.

Continuous filtration equipment falls into two main classes, namely vacuum filtration and centrifugal filtration. Vacuum filtration is an old-established process whereas that of continuous centrifugal filtration is relatively new, its development in Britain being postwar. Materials of a coarse crystalline nature, when produced in sufficient quantity to make continuous separation essential are usually separated by means of the rotary vacuum filter. A typical example of such installations is that used for the separation of common salt from its magma. Normal grade sodium chloride is satisfactorily filtered using the conventional submergence rotary vacuum filter, but the separation of coarse crystal salt requires filtration by means of a headbox or top feed filter. This type of filter does not have the filter drum partially submerged in the magma but instead the magma is deposited onto the filter drum by means of a head box.

Top Feed Filter: This type of filter can, if required, be completely hooded to permit the use of preheated air, which is drawn through the bed of crystals, resulting in a considerable increase in dryness. Using this technique the crystals are removed in stages to give more uniform drying, the final layer being removed just before the headbox. Similar types of filters are in use for the separation of ammonium sulphate in large scale plants.

Small Scale Production

For small scale production, batch centrifuges are used for this separation, but more recently use has been made of continuous centrifugal filters for this purpose. The British-developed centrifugal filter, the Dynocone, is of the solid bowl type in which the solids are removed by a process of centrifugal sedimentation followed by centrifugal drainage. After sedimentation the crystals are removed from the magma by means of a screw conveyor and centrifugally drained *en route*. This conveyor rotates at a slightly higher speed than the bowl itself.

When considering that a small speed difference is most suitable, the problem of driving the two rotating units can be appreciated. This has been overcome by using a planetary gear box, the conveyor being carried on the output shaft of this box. The relative movement between the conveyor and the bowl is obtained by arranging a speed difference between the gear box input shaft, which is belt coupled to a small 'conveyor control motor', and the machine. The gearing is so arranged that under load the resistance between the conveyor and the bowl due to solids removal produces a generated current in the control motor circuit, this current increasing as the load is increased. This type of drive is the subject of British and foreign patents.

Centrifuge Installation: When processing ammonium sulphate the operation is continuous, dewatering the crystals to a moisture content as low as 0.6 per cent. The crystals are washed free of acid in the machine using water only at a rate of approximately 10 gall. per ton of crystals separated. At such dryness little further drying is required.

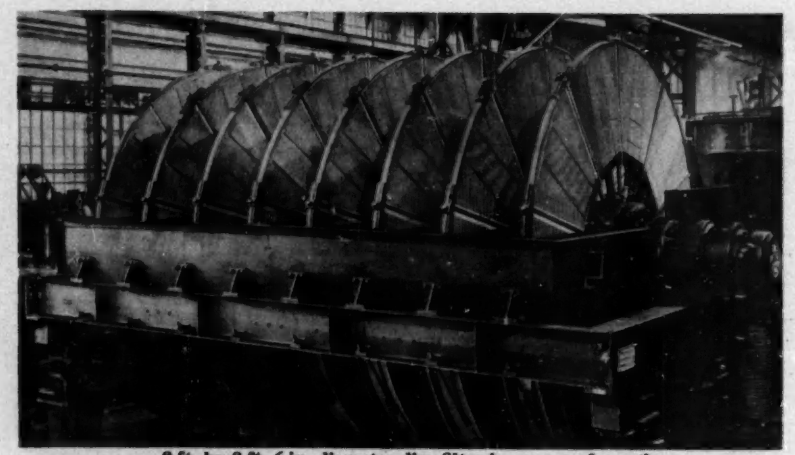
Following the success of centrifugal filtration of ammonium sulphate various industries have installed machines of this type for handling other crystals. Such machines are inexpensive to install, require relatively small floor space, do not need heavy foundations, have low power consumption, and require minimum operating labour. Where the handling of large quantities of crystals is involved, however, the vacuum filter may prove more economical, depending on process conditions.

A centrifugal filter of slightly different design to the crystal handling unit has been developed for fine precipitates. Certain of these difficult filtering materials are readily separated by centrifugal means giving high degree of operating efficiency.

The filtration of liquids containing fine solids in suspension has long been a problem of concern to many industries. Hitherto such a process has been a batch method probably using a number of plate and frame type presses which have not yet been constructed in such a manner as to be fully continuous in operation. In a number of industries the separation of fine suspensions is now carried out using pre-coat filtration technique. This is a slight variation of conventional rotary vacuum filtration.

Pre-coat Filter. This has a filter surface which is always under vacuum, and before operation starts, a layer of diatomaceous earth is deposited on the filter cloth by normal filtration means. A layer of precoat, up to an average of 2 in. thickness can be applied in this manner; this then becomes the actual filtering medium. During filtration a 'skin' of solids forms on the surface of the precoat, clear filtrate passing through to the vacuum receiver. On each revolution of the filter drum the take-off knife advances a predetermined distance, and shaves off a thin layer of precoat exposing a fresh layer for the next cycle of filtration. Using this method, consistent filtration rates are obtained, giving a filtrate high degree of clarity, with a high efficiency of extraction. Precoating is usually carried out each shift or each day according to conditions, and this is the only supervisory labour required. Precoat filtration is widely used in the filtration of antibiotics, food extracts, petroleum products, only to mention a few of the varied industries. It is not entirely new in principle but it is only in recent years that it has been developed to any great extent in Great Britain. String discharge filters are rotary vacuum filters where the filter cake is removed from the filter medium by a series of endless strings which are spaced across the filter drum at intervals of approximately $\frac{1}{4}$ in. The strings leave the filter drum tangentially and pass over a roller, through a comb and back on to the drum via another roller. The strings are automatically tensioned and are cleaned by a comb, which also acts as a string guide.

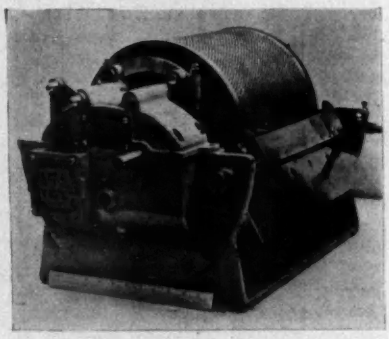
Friable filter cakes are not too satisfactorily handled by this technique since the strings tend to pull through the solids, but those cakes which are of a tenacious plastic nature are readily removed leaving the filter medium in a clean condition. The main advantage of this type of filter is that air blow is not used for cake discharge, consequently, that filtrate held in the capillaries of the cloth and on the underside of filter cake,



8 ft. by 8 ft. 6 in. diameter disc filter in course of erection

is not discharged, thus giving products of lower moisture than by conventional methods. This type of filter finds application in a wide number of industries, paper wastes, certain coal filtration, and general chemical production.

A variation of string discharge is the use of a square link chain, the links being approximately ½ in. square. On passing over the roller at the discharge point the cake carried by the links cracks at the



The 3 sq. ft. laboratory filter

link junction and falls away. This is a continental development and only a few installations are recorded in Great Britain.

The American filter, or as it is most commonly called, the disc filter, is finding increasing use in the coal industry. Mechanical methods of mining have led to considerable increased quantities of fines and these must be separated from the water carrying them. A few years ago this could be quite satisfactorily handled by drum filters, but in recent years the filter area required has increased so rapidly that drum filtration on installations is no longer economical. Disc filters are now taking the place of drum filters in that a large filtration area can be accommodated on a small floor space.

In view of coarse fractions in the fines, considerations have to be given to methods of agitation in the disc filter trough. Various designs have been put forward, but the process of slurry recirculation appears to be the most satisfactory.

Apart from the coal industry the disc filter has found widespread application in the vegetable oil industry, for the filtration of 'foots' from the oil. It is also ideally suited for filtering two different slurries since two units can be built into one single unit, either to combine filtrates or keep them separate. This gives this type of filter great flexibility, and in metalliferous mining this application is widely adopted.

Sewage filtration by rotary vacuum filter is beginning to gain popularity. In the USA more than 700 units have been installed for this purpose, and in Great Britain three principal sewage plants have gone over to their use. For this application, pretreatment of the sewage sludge plays an important part in the filtration characteristics of any particular sludge. Further advances in the technical design of the filter and choice of filter media coupled with improved pretreatment could make vacuum filtration of sewage sludge an economic process.

Numerous theoretical considerations have been given to the evaluation of continuous filtration characteristics mainly based on Poisjeulles equation. This is quite satisfactory from an academic point of view but from a practical viewpoint it is of little value. The only true way to estimate the filtration characteristics of any material, whether vacuum or centrifugal filtration is considered, is to carry out tests on an actual unit.

In this respect there has been considerable development in pilot units. A small three sq. ft. filter of identical construction to large cell type filters has been designed, and incorporates details such as an independently suspended oscillating agitator, precoat and string discharge attachments. A small solid bowl centrifugal filter of 6 in. bowl diameter and incorporating the regenerative control motor system has also been produced. These two units give basic data on which the size of production units can be based by a simple scaling-up procedure, thus eliminating certain error factors, which have hitherto been present.

Vacuum filter design. Basic vacuum filter design has changed little over the last 20 years, the two basic units being that of cell and pipe types of filter. There is a number of variations on the latter but they all achieve the same result. Design has led to more efficient use of the vacuum supply to give generally more efficient operation.

The advent of centrifugal filters is making choice of unit more selective; the application of vacuum filters is finding increasingly new applications in the new process and product developments of various industries. This will continue for many years, particularly as international competition grows, since low production cost of any material to be sold is one of the most important factors when marketing that product.

(The author wishes to thank the directors of International Combustion Ltd. for permission to publish the above information).

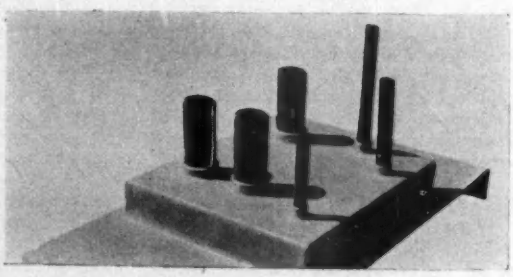
Glass Reinforced Plastics

(*Continued from page* 505)

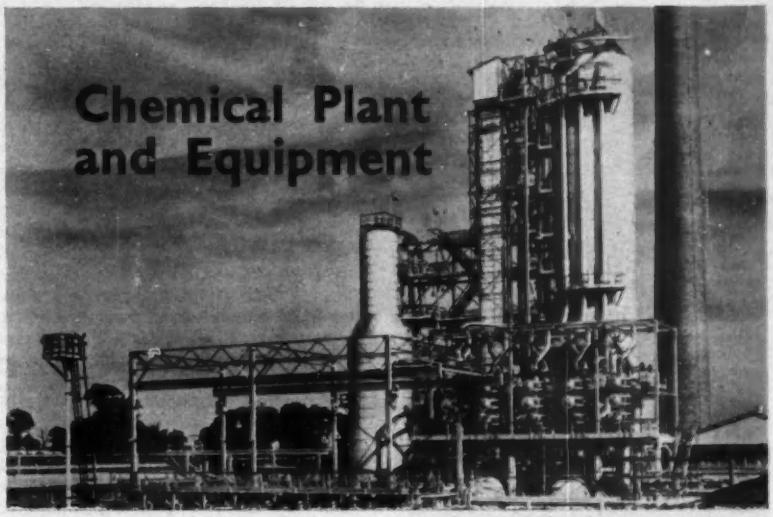
ways. Firstly, the development of new reinforcements with properties specially designed for reinforcing resinous materials and exemplified by newer types of glass for spinning into fibres, and various forms of plate reinforcement. To follow on from the reinforcement we can confidently expect the development of more heat and chemical resistance in the resins currently used—and it should be emphasised—new types of resins altogether.

Finally, the combination of resin and glass to give a structure having the properties required of it is at present largely a hand operation and it is certain that methods of machine application will be developed. Progress in this field has already started with the new MAS machine for spraying mixtures of glass and resin, and this technique is just beginning.

It is believed that the future will show steady and solid progress in the use of glass-fibre reinforced resins for chemical plant until such materials are acknowledged to be engineering materials of construction in their own right, and with widening fields of use.



Section of a Resilon floor covering showing how plinths and pipe work can readily be incorporated



Graphite Heat Exchangers

Heat exchangers designed on the cubic principle are manufactured by *Powell Duffryn Carbon Products Ltd.*, Hayes, Middx. These exchangers are included in many of the plants constructed by them, e.g. sulphuric acid dilution plants, hydrochloric acid absorption and distillation, and sulphuryl-chloride recovery. The basis of the exchangers is the sub-assembly consisting of a graphite block held in compression by two clamping plates. By varying the choice of interchangeable header, the same sub-assembly may be used for a wide range of flows. At the present time, Powell Duffryn make 28 different sub-assemblies, ranging from 1.5 sq. ft. to 250 sq. ft. of heat transfer area.

By employing new resin impregnants, nearly all organic materials can now be handled in their exchangers, whether heating, cooling, boiling or condensing; mixtures of organics and inorganics can also be handled. This has resulted in the use of the units as condensers in the pharmaceutical industry, and also for general applications in petrochemicals. In the latter case, the units have been specially modified to handle pressures up to 100 p.s.i.

Powell Duffryn also manufacture steam and water-operated ejectors in carbon.

Acid Resisting Pipes

Acid-resisting plumbing equipment, under the trade name Vulcathene (polythene) is produced by *J. S. and F. Folkyard Ltd.*, Rectory Lane, Edgware, Middlesex. Acid-resisting pipes, couplers, elbows, square tees, branches and junctions, sweep bends, cleaning eyes, waste or drain fittings, trap units, flanged sweep bends and tees and loose flanges are all available. The fittings are made in all sizes from ½ in. up to 4 in. Large hose equipment can also be obtained.

The company has a patented method of joining Vulcathene pipe to Vulcathene fittings without the use of any other material, which is known as Polyfusion. Joints are made by applying Vulcathene fitting and pipe to a specially designed and patented tool, previously heated, which not only automatically corrects the size of the parts to be joined, but creates a predetermined behaviour of the material which amalgamates maximum density and strength.

Polyfusion tools can be purchased as a complete kit.

Fume Extraction Fans

Two types of fume extraction fan in plastics material are introduced by *K. W. Chemicals Ltd.*, 41 Kingsway, London WC2.

A p.v.c. lined fan offers good resistance to corrosion against most types of fumes, and because of its high comparative strength to rigid p.v.c. is stated to be especially suitable for installations where a high extraction rate, and consequent high stress, is required.

The pure p.v.c. fan offers complete resistance to corrosive fumes and may be used where very high stresses are not involved.

This company also offers an extensive range of fume extraction ducting, lip extractors, hoods, fume cupboards, and scrubbing towers manufactured in p.v.c. polythene and h.d. polythene.

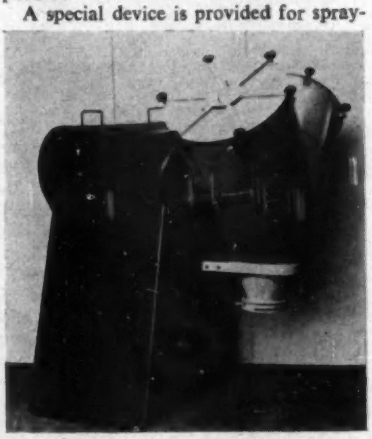
For the handling of corrosive liquids, there is the combined p.v.c. polythene valve. The body of the valve is moulded in the more resilient polythene and the working parts are made in the more rigid p.v.c. Made in four bore sizes, the valve has proved to be suitable for carrying corrosive liquids.

A simple and safe means of transferring acids from one container to another is the polythene syphon. It is self-priming and has a stop cock incorporated, so that it is possible to measure out accurate quantities as and when required.

Powder Mixer

Moritz Chemical Engineering Co. Ltd., 204 Earls Court Road, London SW5, are makers of a 'V' type powder mixer. It is similar to US models, but revolving in a perpendicular plane, the powder in the mixer moves from one leg of the 'V' to the other. The principle is displacement of the point of impact of the flow by rotation, which is claimed to be an improvement on the horizontal rotation, where there is an equal chance of the powder going into one leg or the other. The mixing is done without the aid of paddles.

A special device is provided for spraying a liquid into the powders, and the container may be supplied in mild steel, stainless steel, plastics or other materials. Six sizes are in production, and a number are in use on the Continent.



The Moritz V-shape powder mixer

Hot Air Blower

The new industrial hot air blower known as the Secomak re-entrant heater, recently introduced by *Service Electric Co. Ltd.*, Honeypot Lane, Stanmore, Middx., is about to be put on the market. This heater is designed for use where exceptionally high temperatures are required, or for the reduction of the loading of the element to a minimum.

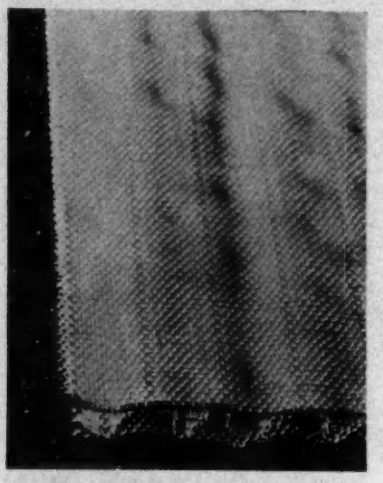
Maximum nozzle temperature of the re-entrant heater is 900°F. In the heater, air is preheated by being circulated between concentric tubes before finally passing over the element. An advantage of this is that the outside of the heater runs comparatively cool. The heater may be fitted to the outlet of any Secomak blower, or may be used at the end of a pipe or flexible hose. Air at ambient temperature enters the heater at the left hand end and hot air comes out of the nozzle on the right.

Nozzle diameters range from ½ in. to 2 in. and may be fitted with a 2-in. BSP adaptor. Standard loadings are 1, 2 or 3 kW. Weight of the heater is 9 lb. Overall dimensions are 15 in. long by 4¾ in. by 4¼ in.

Filtration Process Fabrics

The majority of technical fabrics produced by *Fothergill and Harvey Ltd.*, of Peter Street, Manchester 2, have been made from glass yarns, marketed as Tyglas fabrics, and from polyvinylidene chloride monofilaments—known as the Tygan range. For the chemical industry the company has recently introduced a three-dimensional fabric for use in filtration processes. The fabric itself does not act as a filter but is used sandwiched between two filter cloths as a drainage medium. The fabric is woven from polyvinylidene chloride and polythene monofilaments under the Trilock process for which Fothergill and Harvey are licensees in this country. After weaving as a flat fabric, it is given a heat treatment which,

Chemical Plant and Equipment



3-D filtration fabric produced by the differential shrinkage method from polyvinylidene chloride and polythene monofilaments

through the differential shrinkage of the two different monofilaments, produces the three-dimensional effect which can be seen in the accompanying photograph.

In addition to this particular cloth, the company also produce a wide range of filter cloths in constructions suitable for most industrial uses. Among the fibres used are nylon, Terylene, Dynel, Orlon, Thermoville, polythene and low-pressure polythene. Certain Tyglas fabrics have been found particularly suitable in high temperature work.

A recent introduction in the chemical engineering field is Tygascrim, a reinforcing membrane for use in bitumen coating. This is an open-weave cloth woven from glass yarns which is available with two types of coating to give the maximum compatibility with either asphalt-based or coal-tar compounds. Tygascrim is stated to have high tensile and bursting strengths and to be capable of withstanding temperatures of up to 1,000°F without risk of the degradation normally experienced with fabrics made from natural fibres. Pick-up factor of the cloth is of the order of 420 per cent. The fabric is being used in roofing and waterproofing applications and on pipes, joints and fittings and the interiors of storage tanks.

Filming Amines

Houseman and Thompson Ltd., of D. M. House, Newcastle-upon-Tyne 2, market a range of filming amines which are of value in preventing corrosion in steam and cooling water systems.

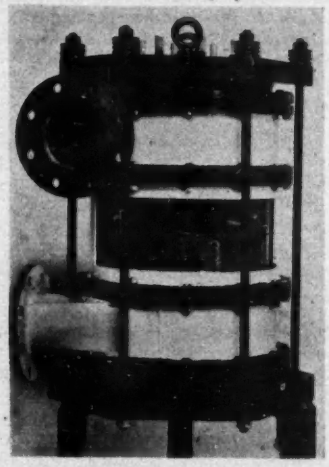
Employed in small quantities of the order of 1-5 p.p.m. in steam-filming amines are stated to provide a high degree of protection to metals in contact with low pH condense-water by plating out as a thin impermeable film on the wetted surfaces. The material is easy to handle and is simply administered by injection to the boiler feed line, the boiler itself or to the steam line. No impedance is offered to heat transfer by the deposition of the corrosion resisting barrier on the condensing surfaces, and in fact the rate of heat transfer may be increased by five to 10 per cent due to the removal of existing corrosion products by the amine and the promotion of dropwise condensation of the steam.

In cooling systems the quaternary ammonium salts and acetate salts of certain fatty acid-derived amines prevent algae growth and inhibit corrosion. Heat transfer is improved by removal of corrosion products and the general cleaning effect of the amine.

Filming amines are supplied by chemical division, *Armour and Co. Ltd.*, London. By arrangement with this company these amines are distributed for water treatment in the UK and abroad by Houseman and Thompson Ltd., who offer a complete advisory service on their application to industrial steam and water systems.

Heat Exchanger

A new item by *Robert Jenkins and Co. Ltd.*, 149-151 Abbey House, Victoria Street, Westminster, London SW1, is the Polybloc graphite heat exchanger, which is being made in England under licence from Le Carbone-Lorraine. The Polybloc heat exchanger consists of a pile of impermeable cylindrical graphite blocks



Robert Jenkins' Polybloc graphite heat exchanger with casing and block part cut away

having two groups of flow passages for two different heat exchange fluids. One group is parallel to the axis and the second group is arranged radially. Elastic gaskets between the blocks prevent contact between the separate fluids.

The performance of the Polybloc is based on the corrosion resistance of graphite and the following principles which are stated to give the exchanger a high efficiency: Fluid flow is through very short passages providing continuous turbulence for highest possible heat transfer; the use of monolithic graphite blocks with correct orientation of the crystals providing most favourable thermal conductivity; and absence of cemented joints.

Heat exchange area can be increased by the addition of standard graphite blocks and outer shell elements, so permitting a complete range of sizes.

Two models are available—a small model and the standard type.

Drum Heater

A drum heater in two sizes to fit standard 15 or 45 gall. drums is produced by *Stabilag Ltd.*, Hemel Hempstead, Herts. It is designed to facilitate the removal of viscous materials such as paints, resins, oils, waxes, bitumens, tars and tallows. Fabricated from 16 s.w.g. mild steel sheet with a 1 in. reinforced angle frame, the drum heater is split into two hinged halves, secured by hinges with knock-out pins. Heating panels are fitted, one in each half, and the patent form of the element distributes the heat evenly over the whole of the surface. Two heavy duty thermostats, controlling 3 kW, limit the temperature of the air surrounding the drum to the setting required, to a maximum on standard models of 450°F.

Handling Equipment

For a wide variety of industrial uses, *Tyne Truck and Trolley Ltd.*, Team Valley Estate, Gateshead-on-Tyne, produce barrows, trucks, drum drain stands, carboy trucks and tilters, portable elevators and other handling equipment. They can also provide any special type of truck to specification.

Heating and Circulating Nozzles

A new acid circulator has been introduced recently by *Haughton's Metallic Co. Ltd.*, 30 St. Mary-at-Hill, London EC3. These circulators are made of Ironac high silicon iron which is resistant to the action of acids. Haughton claim that they are economical in use and prove a satisfactory method of heating up liquids and circulating the same.

Supply pipes can be of regulus metal or plastics material, or of Ironac metal, according to requirements.

These circulators are largely used for acid tanks, for pickling tanks and for heating and circulating hot or cold acids and acid liquors in tanks.

Hydraulic Pressure Cleaning

A smaller model than the high pressure cleaning unit described in CHEMICAL AGE 6 April, p. 611, has been introduced by *Joseph Evans and Sons (Wolverhampton) Ltd.*, Culwell Works, Wolverhampton. The model described earlier is designed so that two jet cleaning guns can be used simultaneously. In this case the pump delivers 16.5 g.p.m. of water against 1,000 p.s.i.g. pressure, each gun taking approximately 7 g.p.m. The motor to drive is 15 b.h.p.

To meet the demands for a smaller, less expensive equipment, a single gun unit has been developed. The pump in this case is a 1 in. by 3 in. totally enclosed horizontal Triplex plunger type delivering 6.3 g.p.m. at 850 p.s.i.g. pressure, and

having a driving motor of 5 b.h.p. The jet gun is designed to entrain air and/or sand for cleaning operations. An adjustable spray can be fitted to the gun and included are also self-propelled pipe cleaning nozzles. An unloading valve is fitted to the pump which automatically by-passes full pump output back to the suction and enables the equipment to be controlled by one man at the gun.

New Gland Packings and Jointings

Recent Lascar packings and jointings introduced for the chemical industry by *Beldam Asbestos Co. Ltd.*, Lascar House, Hounslow, Middlesex, include Beldamok alkali packing and Solvo packing.

The alkali packing is a plaited packing manufactured from high-grade white asbestos yarns, lubricated with a special alkali resistant grease and mica. The packing is said to be highly resistant to the action of a wide range of alkalis and caustics and is intended for general service with these liquids on pumps, valves, and all gland applications. The Solvo packing is manufactured from white asbestos yarns plaited through a special blended lubricant that is resistant to oils, solvents, and petroleum distillates. Particular value of this packing is stated to be in applications where good water-resisting properties are required, such as in systems that are flushed through with water at regular intervals, as the lubricant is also suitable for service with water.

The packing is primarily intended for service with rotating pumps and valves, but it is also suitable for other applications.

Beldamokflon and Lascidflon packings are manufactured from white asbestos and blue asbestos yarns respectively, plaited through a lubricant consisting of Fluon grease (polytetrafluoroethylene), which renders them impervious to the action of concentrated acids. Lascidflon, since it is manufactured from blue asbestos yarns of high quality that are highly resistant to chemical attack, is claimed to be particularly suitable for service with strong acids.

New Air Compressor By BEN Patents

A recent addition to the range of air compressor units produced by *B.E.N. Patents Ltd.*, P.O. Box 10, High Wycombe, Bucks, is the BEN model VI unit. This unit was introduced to meet the demand for a source of compressed air for a wide variety of duties, requiring a small volume of air at pressures up to 50 lb. sq. in. It comprises a single cylinder air-cooled compressor, 2 in. bore by 1 in. stroke, with a displacement of 1.7 cu. ft. per minute, direct coupled to an electric motor and arranged for fully automatic control by means of an electro-pneumatic pressure switch.

The compressor is fitted with an efficient silencer, intake filter, air pressure gauges, adjustable relief valve and pressure regulating valves, the whole being mounted on an air receiver 12 in by 15 in. of 1.25 cu. ft. providing a smooth running unit, silent in operation, easily portable and occupying the minimum of floor space.

Computing Pipe Stress Problems

For the computation of stresses in three-dimensional, multi-anchor pipe systems, or of two-anchor systems as a particular case, *Ferranti Ltd.*, Hollingwood, Lancashire, are introducing the Ferranti Pegasus computer. It will find application for steam or hydraulic pipe layouts in chemical plant.

The method of pipe stress analysis developed by Mr. H. M. Gemmell has been adapted for automatic computation.

Any multi-anchor system or pipe layout, up to a maximum of nine anchors can be dealt with. Analysis falls into two parts. The first part consists of the analysis of a single branch assumed to be fixed at one end, that is, computation of a flexible matrix. The second part of the analysis consists of utilising flexible matrices.

Input of deflection data and the calculation of stresses comprise the final stage of the calculation, and very little time is required, the makers state, to put in a whole series of sets of deflections, thus readily stressing the whole system under a wide range of physical conditions.

When a designer finds it necessary to alter a pipe system, either by changing the layout, or by adding a pipe, or by changing a pipe cross-section, only a short time is required for the whole calculation using the computer.

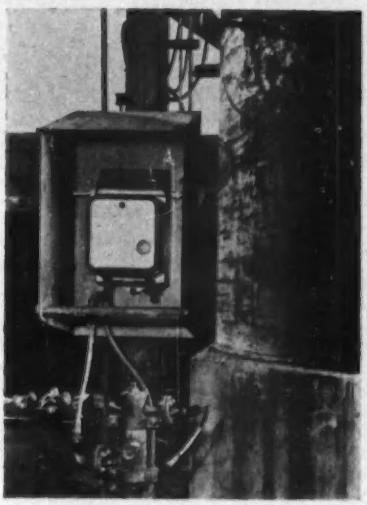
In order to satisfy the need for an instrument to measure viscosity under industrial conditions, Ferranti Ltd. have developed the Ferranti Viscometer. This consists of a rotating outer cylinder driven by a small motor with a second cylinder located coaxially within it. To measure the viscosity of a liquid, the cylinders are immersed in the liquid, the motor is switched on and the viscosity is read on the calibrated dial at the top of the instrument. Any change in viscosity due to such causes as change in temperature, chemical composition or thixotropy of the liquid, can be observed continuously, allowing the continuous indication of viscosity changes of as low as 0.1 centipoise.

Ferranti portable viscometer

For determination of the anomalous behaviour of non-Newtonian liquids a wide range of shear rates is provided by the combined effect of a quick-change 3-speed or 5-speed gearbox and a set of three or more interchangeable inner cylinders.

Oxygen Analyser by George Kent

An analyser for an oxygen controller manufactured by *George Kent Ltd.*, Luton, is suitable for applications such as sulphur recovery plants, where it can be



Analysis cabinet of the Kent oxygen controller on the after-oxidation kiln of a sulphur-recovery plant

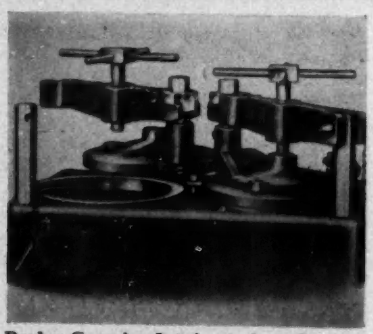
used for maintaining the percentage oxygen content of the gas discharged from the after-oxidation kiln at a predetermined value. Calibration is not affected by small amounts of hydrogen or other gases, and all parts in contact with the gas sample are made from corrosion-resisting materials. No chemicals are used in the analyser, a purely physical method of measurement, depending on the para-magnetism of oxygen, being employed.

Royles Twin Strainer

Royles Ltd., Irlam, Manchester, have supplemented their twin strainer type 'G' with a new model (series 2) incorporating design improvements which are said to reduce considerably maintenance time and cost. Quick release cage covers now take the place of studded joints, enabling the cages to be rapidly removed and replaced by unskilled labour.

The cover is secured by means of a capstan type screw and cross bar, the actual design varying somewhat according to the size of strainer. The covers are spring loaded so that when the pressure applied by the capstan screw is released, the spring breaks the joint between the cover and strainer body, lifting the cover so that it can be easily swung aside.

Chemical Plant and Equipment



Royles G series 2 twin strainer for bore sizes 12-18 in.

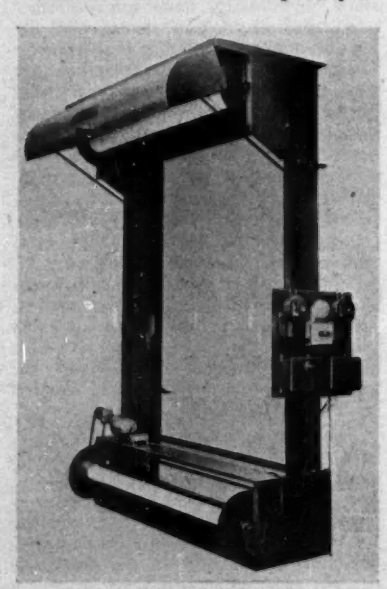
The modified strainer is available in ten sizes—3 in. bore to 18 in. bore. Indicator gear denoting which strainer is in use is provided as standard. If desired, chain wheel gear for intercoupling the two valve spindles, to ensure both slide valves move simultaneously, can be supplied on request.

Air Filtration

Among recent equipment introduced by *Vokes Ltd.*, Henley Park, Guildford Surrey, is the Autoroll automatic air filter. This filter is of the automatic type in which the effective area of a fibrous filtering medium is disposed between two spools, the upper spool containing the clean medium and the lower the soiled medium.

Passage of the filter medium from the top spool, across the air flow aperture and on to the bottom spool is effected automatically by means of a geared motor drive caused to operate intermittently on a time cycle or by a pressure differential switch. The filtering medium is a fibrous mat carded to an even density and fused at the intersections to give ample strength to resist the tension met in service.

Described as a new concept in principle and performance, the Autoroll is claimed to be suitable for air conditioning and ventilating systems or any large capacity air filtration installation.



Vokes Autoroll air filter

Another recent introduction by Vokes is the SC automatic rotary screen air filter. This unit is fully automatic in operation and consists basically of a number of special type filter panels which constantly circulate through a trough of oil. Dirt is collected on a film of this oil and after flushing out in the trough it settles at the bottom of the tank. The only servicing said to be necessary is periodic removal of the sludge and maintenance of the correct oil level.

Two other new items are the multiple cyclone dust collector and the absolute air filter.

High Temperature Oven

Electric equipment manufactured by *AEW Ltd.*, Imperial Works, Edgware, Middlesex, is supplied to the Atomic Energy Authority, Ministry of Supply, Crown Agents for the Colonies and many chemical and aircraft manufacturers. A new high temperature electric oven now in production will operate in the temperature range 400°C-700°C, and is heated by replaceable Inconel sheathed 80/20 nickel chrome elements, evenly distributed over the back of the oven in a separate compartment.

Temperature is automatically controlled by an indicating thermometer regulator in circuit with a special relay to reduce contact load and contactor chatter, and an energy regulator is incorporated to obtain close differential over the full temperature range. An impeller fan driven by a synchronous electric motor exhausts and re-circulates air in the oven. The oven is rated to reach maximum temperature in one hour from cold.

Mechanised Handling

In stressing the advantages of mechanised handling in the chemical and pharmaceutical industries, *Ransomes Sims and Jefferies Ltd.*, Ipswich, state that the electric truck provides a clean, fumeless and odourless form of traction. They have recently introduced the NR 15 forklift electric truck which has a carrying capacity of up to 15 cwt. It closely follows the design of model FL 10, but is rated in accordance with the stability tests being introduced by the British Industrial Truck Association.

Centrifugal Pumps

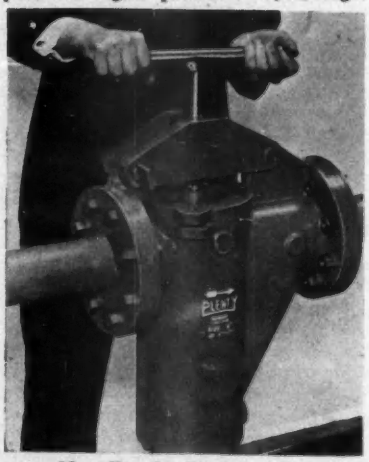
Equipment supplied by *Girdlestone Pumps Ltd.*, Woodbridge, Suffolk, for the chemical industry includes stainless steel centrifugal pumps, cast iron, bronze or rubber-lined diaphragm pumps for handling abrasive and corrosive fluids and Seal centrifugal pumps, which are specially designed for incorporating mechanical shaft seals. These can be supplied with cast iron, bronze or stainless steel liquid ends. The simple and effective arrangement of the mechanical seal is stated by the manufacturers to have these advantages: complete cooling of the seal by the liquid pumped without resort to flushing pipes; large internal liquid area prevents settlement of suspended or foreign matter around the seal; and, replacement of the seal is a simple matter, only the suction end cover and impeller needing to be removed. Suitable mechanical seals are available for most solvents, many acids and many other difficult liquids.

These pump units, comprising volute, impeller, suction end cover and mechanical seal, are available with delivery connections in five sizes from ¾ in. to 1½ in. All five sizes have the same shaft and flange dimensions for interchangeability of mounting.

Girdlestone also supply plant switches for automatic and remote control of liquid levels. These can be supplied with stainless steel or polythene float equipment according to the liquid involved.

Range of Filters

A range of filters for the oil and chemical industries is in production by *Plenty and Son Ltd.*, Eagle Iron Works, Newbury, Berks. The range covers bores from 1 to 24 in. at 300 p.s.i.g. working pressure, and special filters can be supplied for higher pressures Filter cages



New filter by Plenty and Son

are of steel for oil service and brass or copper for water service, normally with 1/16th in. perforations, and a filter surface of over 12½ times the pipe area is provided.

Vent and gauge connections are placed at inlet and outlet, and on both sides of the body. There are alternative bottom or side drains to suit all site conditions. It is claimed that no tools are required to service these filters, and that there is virtually no spillage when removing the filter cage for cleaning.

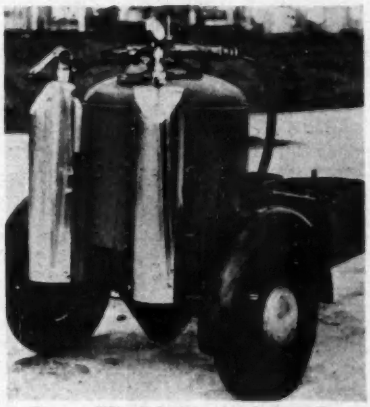
New Dry Chemical Fire Fighting Unit

The *Pyrene Co. Ltd.*, Brentford, Middx., have introduced a new large-capacity dry chemical fire-fighting unit. This consists of a pressurised container mounted on a two-wheel trailer, with coupling attachment, and fitted with a hose container The fire-extinguishing charge is 600 lb. of dry chemical which is expelled under pressure provided by a pair of 20-lb. lever-operated CO_2

gas cylinders, through two 60-ft. lines of high pressure hose terminating in nozzles with shut-off valves. These controllable nozzles enable the trailer to be operated by two men. The total duration of discharge, using both 'guns' continuously, is 1½ minutes. The 'guns' provide either a jet or a diffused fan of fire-extinguishing dry chemical powder as required. This unit is fully mobile.

A typical Pyrene dry chemical installation recently constructed protects a hydrocortisone plant. It comprises two dry chemical containers, each filled with 150 lb. of dry chemical. On operation of a manual handle, two 10-lb. CO_2 gas cylinders are simultaneously discharged, each connected to one of the containers for pressurising and expelling the dry chemical, through specially designed pipework and discharge nozzles placed at strategic positions around the cortisone plant.

The new Pyrene FB 10X short foam branchpipe is said to be particularly effective for the application of foam in large quantities to highly inflammable fire risks of all kinds. Its operating pressure is 60 lb. sq. m., at which pressure it passes 100 gallons of foam solution per minute. Foam expansion ratio is 10:1 and under favourable conditions expansion ratios of the order of 13:1 can be obtained. With a water pressure of 100



Pyrene PD 600 dry chemical trailer

lb. sq. m., the FB 10X is capable of delivering 1,500 gallons of foam per minute. After dealing with the highly inflammable materials, the foam supply may be shut off and the branchpipe used to project water only, for cooling down purposes and for extinguishing freely burning materials to which the fire may have spread.

A typical Pyrene pre-mix foam fire-extinguishing installation at a large chemical works protects stores of inflammable liquid. Foam solution is contained in a 4,000-gall. storage tank; a battery of CO_2 gas cylinders pressurises the tank when the system is actuated by one of the fusible link fire detectors (since in certain circumstances fire may be detected visually even before sufficient temperature is reached to fuse the link, manual operation can be provided). To operate the installation, the CO_2 gas is released into the headspace of the tank, forcing the solution through the pipework to the foam-makers, whence it is poured on the fire area as foam.

Molten Metal Mopump

The vertical Mopump for handling molten metals and salts has been developed by *Rhodes, Brydon and Youatt Ltd.*, Gorsey Mount Street, Stockport, to handle relatively low melting point metals such as tin, lead, sodium, etc., and molten inorganic chemicals such as sodium and potassium nitrates and caustic soda, or high temperature heat transfer media. They can be supplied in materials capable of withstanding temperatures up to 850°C., and are of two basic types. They can be suspended over the liquid on an adjustable hoist, or permanently installed in a cover plate over a vessel containing the liquid.

Both models are available in 1, 1½, 2 and 2½ in. delivery pipe diameter for heads up to 40 total ft. These pumps are fully described in leaflet 1524, the company's latest publication.

Diaphragm Pumps

Hand operated and power driven diaphragm pumps are available from *Wilkinson Rubber Linatex Ltd.*, Camberley, Surrey. Claimed to be equally suitable for corrosive liquids or for slurries that are both abrasive and corrosive, the pumps are designed to prevent metallic contamination of the liquids inside.

In both cases they are lined with Linatex rubber and employ solid Linatex valves and diaphragms.

Performance data are as follows:

Power driven

	Pumping chemicals	pumping slurries
Max. static discharged head	25 ft.	17 ft
Max. suction lift	10 ft.	6 ft.
Max. rate of discharge	400 gall/hr.	250 gall/hr.
Max. stroke	1¼ in.	1¼ in

Hand operated: It is claimed that a static discharge head of 25 ft. can be reached by an average operator maintaining a full steady stroke on the handle. Under these conditions a suction lift of 10 ft. can also be obtained and a nominal rate of pumping equivalent to 400 g.p.h.

Liquid Flow Recorder

The Arkon recorder of *Walker, Crossweller and Co. Ltd.*, Cheltenham, automatically provides a clear, continuous record day and night of the rate of outflow of trade effluent and industrial liquors. Use is made of the V-notch weir principle in which the head of liquid over the weir has a known relationship to the rate of flow, the angle of the V-notch being chosen to suit the maximum rate of flow in the installation.

A small supply of air or gas is taken to a dip tube which is inserted in the liquid at a suitable point. From the dip tube a connection is taken to an Arkon recorder model 1600. The pressure developed in the dip tube and in the connection to the recorder is equivalent to the head of liquid on the dip tube.

Arkon V-notch liquid flow recorder installation

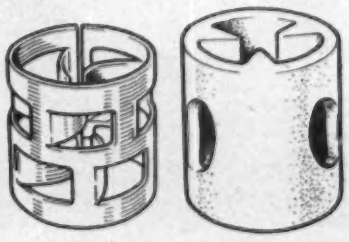
As the head varies, so the pressure to the recorder varies; this information is written on a chart in terms of gallons (or other selected units) per minute, hour or day.

Tower Packings

Weinreb and Randall Ltd., Watchtower Works, Greenside Road, Croydon, Surrey, specialise in tower packings of all types, and in all materials and sizes. For many years the simple types of ring and Berl saddle have been used for nearly all applications.

Recently new types of packing have been developed to increase throughput and contact efficiency, and to reduce pressure. The most successful of these is the German pall ring, and an equivalent British pattern called the slot-wall-ring is now available in metals and chemical stoneware. This pattern has been used extensively by Marchon Products Ltd.; by Roche Products Ltd. for their new synthetic vitamin factory; and has been tested and approved for use by the Associated Ethyl Co. for their Anglesey plant. In this last case the total requirement runs into thousands of tons and the slight extra cost is claimed to be more than offset by overall savings on capital and running costs.

Ceramic balls for grinding, catalyst



Tower Packings

Chemical Plant and Equipment

support and heat transfer purposes, are also supplied. A large order has been obtained from the Power Gas Corp. for high alumina balls, made by a new method, for a regenerative heat exchanger process working at temperatures up to about 1,750°C.

Heavy Duty Plastics Tubing

The excellent chemical resistance of unplasticised p.v.c. together with a high impact strength are claimed to be combined in Polyorc BH made by the *Yorkshire Copper Works Ltd.*, Leeds. Tubing made in this new material is said to be suitable for conveying corrosive liquids such as acids and alkalis.

It is almost impossible to fracture Polyorc BH tubing claim the makers and its rigidity, even in long lengths, means fewer clips or supports in the pipe run. It is non-inflammable and can be used where stringent fire precautions are observed.

In addition to Polyorc BH, Yorkshire Copper Works are manufacturers of polythene tubing, both as Polyorc A ordinary and Plastronga high-strength. Plastronga tubing is made from polythene produced by the Ziegler or low-pressure process. It is claimed that normal gauge tubes in this material are just as strong as ordinary polythene tubing in heavy gauges and cost less.

Electrical Precipitators

Gas cleaning equipment produced by *W. C. Holmes, Ltd.*, Turnbridge, Huddersfield, include the Holmes-Elex electrical precipitator. It consists essentially of two sets of electrodes, one comprising the discharge or negative electrodes which are designed to facilitate electrical discharge from their surfaces, and the other termed receiving or positive electrodes, the purpose of which is to collect the precipitated material temporarily, simultaneously dissipating electrical charges on the particles to earth before the material falls by gravity into a hopper.

The negative electrodes are connected to the output side of a high voltage rectifier providing direct current which charges the wires to the required potential. From the wires a corona discharge is established which ionises the gases passing through the unit. The potentials employed are in the region of 30,000 and 70,000 volts, and the consumption depends upon the number, length and shape of electrodes as well as the properties of the gas.

Industrial Instruments

Negretti and Zambra Ltd., 122 Regent Street, London W1, produce a wide range of industrial instruments, for indicating, recording and controlling temperature, pressure, humidity, volume and flow.

A process programme recorder and controller manufactured by Negretti and Zambra operates solely by pneumatic means, except for the chart motor and indicator lamps. It operates in conjunction with a standard pneumatically-operated temperature transmitter, installed in the plant itself. The air supply is of 30 p.s.i. minimum, and the minimum and maximum process temperatures and the rates of rise between them are infinitely variable. Four programmes can be chosen by selective push-button operation, and the controller incorporates three control settings, one each for minimum and maximum process temperatures and a third for the rate of rise of temperature.

Fluid Energy Mill

Now being installed in the test house of *KEK Ltd.*, Palmerston Street, Ancoats, Manchester 12, is a Wheeler- Stephanoff fluid energy mill, model 0202-2 (for product development work). It is the only one of its kind in the UK. KEK Ltd. have been granted the sole selling agency for Wheeler-Stephanoff. The company also state that they are fully equipped to deal with any problems concerning the reduction of materials to very fine powder.

The Wheeler-Stephanoff mill is described as an improvement on previous fluid energy type grinders in that the inclusion of occasional large particles in the product due to 'kick-over' in the separation process is eliminated. It is also stated that this improved mill will grind the most abrasive materials without appreciable metallic contamination of the end product.

These fluid energy grinding mills have no moving parts. Grinding and dehydration are achieved by pressurised fluid, such as superheated steam, compressed air, or other gases.

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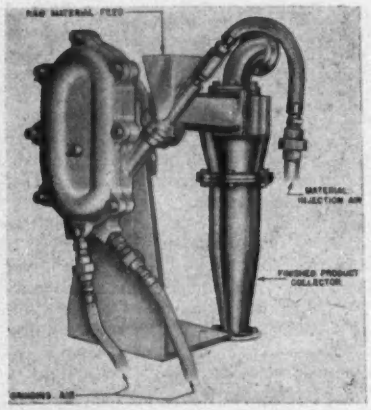

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It is claimed that in many cases tanks in cold rooms can be re-lined with a stoved lining where the ambient temperature is at freezing point while carrying out the work.

Range of Thermometers

Thermometers made by *G. H. Zeal Ltd.*, Lombard, Morden Road, London SW19, can be supplied in the straight form, right angle or obtuse angle and in various ranges and stem lengths. Brass or steel pockets can be supplied with the instrument so that it can be removed from the plant without interfering with flow.

Constant Rate Feeder

Among automatic weighing equipment made by *Magnetic Equipment Ltd.*, Portchester, Hants, is a constant weight gravimetric feeder. Rated at 50 tons per hour and with feed capacities from 1 to 200 t.p.h. the feeder is designed for industrial installations where a number of materials have to be continuously discharged at exact rates before mixing together to form a single product.

This Margo feeder comprises a vibratory feeder of controlled output discharging into a pivoted conveyor, the feed falling on to the belt at the end remote from the pivot, ensuring that the turning moment is

at a maximum. The conveyor is driven by a constant speed motor except in the case of remote control machines where the drive is by an electronically controlled variable speed motor.

The conveyor is counterbalanced by a steelyard in a dust-tight case; for manual control machines, adjustment of discharge is by moving the steelyard weights, for remote control the belt speed is varied. There is no mechanical connection between the steelyard and control, as electronic control is considered to give a high degree of accuracy.

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The Vacu-Blast Major consists of a generator-reclaimer unit and a dust collector fitted with a 15 h.p. electric motor and starter. These two sections may be integrated to form a single unit or they may be separated by up to 75 ft. if necessary. The operator can work at a hose reach of 75 ft. from the gun to the generator-reclaimer unit. A vertical lift of 40 ft. is also possible. A variety of abrasives may be used and abrasive consumption varies between 3 and 6 lb. an hour. The machine requires 130 c.f.m. of clean dry air compressed to 100 p.s.i.

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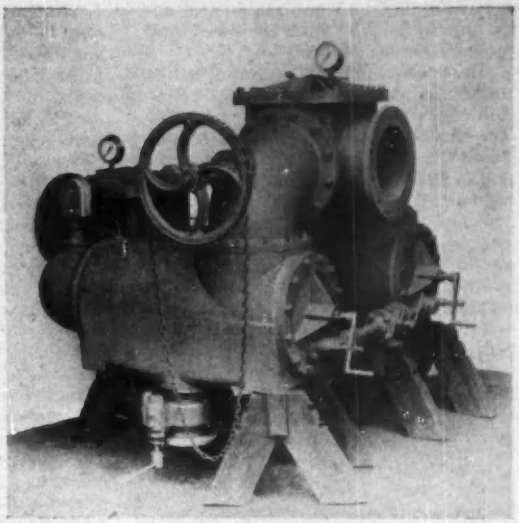
The new tank washing nozzle produced by *H. T. Watson Ltd.*, Croft Street, Widnes, has been developed as a result of demands for providing complete internal cleansing of big tanks. Tanks up to 20 ft. diameter can be satisfactorily cleansed on the inside surfaces depending on the liquid pressure available at the nozzle. The nozzle is lowered through the manhole of a tank or other branch connection having a hole not less than 5 in. diameter, and provides thorough cleansing of the sides and bottom of the tanks. A further row of six nozzles can be placed at the top angled upwards to clean the internal top surface.

Multi-head tank washing nozzle

Brackett self-cleaning circulating water screen



A perforated strainer is incorporated to prevent blockage of the nozzles which are of free passage type. Each nozzle produces a full cone hard hitting spray characteristic, the angle of which is so disposed as to ensure complete coverage of the inside surfaces of the tank. The unit is screwed for connection on to a 1¼ in. nominal bore pipe which provides the necessary extension to locate the nozzle centrally within the tank to be cleaned.

The unit is available in various materials—brass or 18-8-3 stainless steel as standard.

Throughput of the tank washing assembly is dependent on the individual nozzle capacities and the number of nozzles fitted, but for the unit shown, throughput would be 83 g.p.m. at 50 p.s.i. Pressure can be varied with the nature of the material to be scrubbed from the sides of the tank, but normally 50 p.s.i. is recommended.

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Water Screens

Self-cleaning circulating water screens are one of the products of *F. W. Brackett and Co. Ltd.*, Hythe Bridge Ironworks, Colchester. They are installed in many chemical plants in this country and abroad, and their chief feature is that the strainer baskets can be cleaned without removal from their housing. In some cases the self-cleaning feature is not required, and the company can provide normal non-self-cleaning strainers.

By opening and closing valves in the twin strainers, the continuously flowing unscreened liquid is by-passed to a clean strainer basket, while the dirty basket is being washed and accumulated screenings ejected from the isolated strainer.

Standard strainers are constructed in cast-iron, with baskets provided with $^{3}/_{32}$in. square holes, cock-plugs and valves being of gunmetal. Special combinations of metals can be supplied and strainer baskets can be covered in gauze if specially fine screening is required. To avoid frequent cleaning there is waterway area through each perforated basket greatly in excess of area of the pipe to which they are designed to be connected, ensuring long periods of uninterrupted straining, and minimum labour requirements.

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Chemical Plant and Equipment

support and heat transfer purposes, are also supplied. A large order has been obtained from the Power Gas Corp. for high alumina balls, made by a new method, for a regenerative heat exchanger process working at temperatures up to about 1,750°C.

Heavy Duty Plastics Tubing

The excellent chemical resistance of unplasticised p.v.c. together with a high impact strength are claimed to be combined in Polyorc BH made by the *Yorkshire Copper Works Ltd.*, Leeds. Tubing made in this new material is said to be suitable for conveying corrosive liquids such as acids and alkalis.

It is almost impossible to fracture Polyorc BH tubing claim the makers and its rigidity, even in long lengths, means fewer clips or supports in the pipe run. It is non-inflammable and can be used where stringent fire precautions are observed.

In addition to Polyorc BH, Yorkshire Copper Works are manufacturers of polythene tubing, both as Polyorc A ordinary and Plastronga high-strength. Plastronga tubing is made from polythene produced by the Ziegler or low-pressure process. It is claimed that normal gauge tubes in this material are just as strong as ordinary polythene tubing in heavy gauges and cost less.

Electrical Precipitators

Gas cleaning equipment produced by *W. C. Holmes, Ltd.*, Turnbridge, Huddersfield, include the Holmes-Elex electrical precipitator. It consists essentially of two sets of electrodes, one comprising the discharge or negative electrodes which are designed to facilitate electrical discharge from their surfaces, and the other termed receiving or positive electrodes, the purpose of which is to collect the precipitated material temporarily, simultaneously dissipating electrical charges on the particles to earth before the material falls by gravity into a hopper.

The negative electrodes are connected to the output side of a high voltage rectifier providing direct current which charges the wires to the required potential. From the wires a corona discharge is established which ionises the gases passing through the unit. The potentials employed are in the region of 30,000 and 70,000 volts, and the consumption depends upon the number, length and shape of electrodes as well as the properties of the gas.

Industrial Instruments

Negretti and Zambra Ltd., 122 Regent Street, London W1, produce a wide range of industrial instruments, for indicating, recording and controlling temperature, pressure, humidity, volume and flow.

A process programme recorder and controller manufactured by Negretti and Zambra operates solely by pneumatic means, except for the chart motor and indicator lamps. It operates in conjunction with a standard pneumatically-operated temperature transmitter, installed in the plant itself. The air supply is of 30 p.s.i. minimum, and the minimum and maximum process temperatures and the rates of rise between them are infinitely variable. Four programmes can be chosen by selective push-button operation, and the controller incorporates three control settings, one each for minimum and maximum process temperatures and a third for the rate of rise of temperature.

Fluid Energy Mill

Now being installed in the test house of *KEK Ltd.*, Palmerston Street, Ancoats, Manchester 12, is a Wheeler- Stephanoff fluid energy mill, model 0202-2 (for product development work). It is the only one of its kind in the UK. KEK Ltd. have been granted the sole selling agency for Wheeler-Stephanoff. The company also state that they are fully equipped to deal with any problems concerning the reduction of materials to very fine powder.

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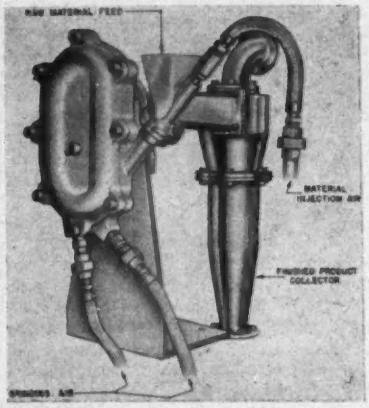

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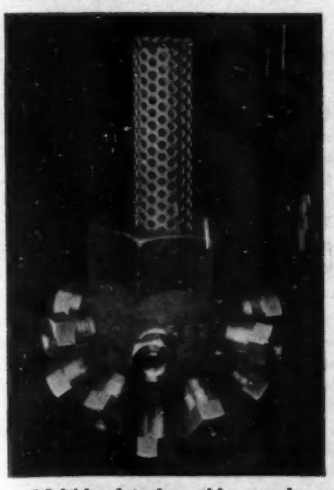

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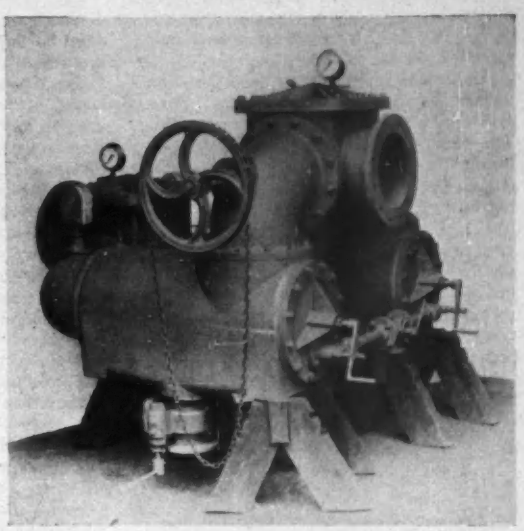

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bellows operates this mechanism after receiving the impulse from the transmitter mounted on the process.

Any position-impulse received from the transmitter causes a proportional position of the sensing arm of the integrator. The sensing arm is either square, root or linear form. A graduated vernier wheel is provided for quick checking and calibration.

Taylor Controls also supply a Transverter transmitter for linear measurement and/or transmission of flow. Available in three forms, indicating transmitter, recording-controlling transmitter and recording transmitter, the instrument can be actuated by a mercury manometer, an aneroid manometer or a low pressure receiving unit.

Welding Inspection

Metal and Pipeline Endurance Ltd., Victoria Street, London SW1, operate a welding inspection and instruction service A recent problem set them by a chemical company was for a method of radiographing through 1½ in. of rubber on impeller blades. The blades were welded to a 36 in. hub, and the complete impeller measured 7 ft. 6 in. diameter, fulfilling a 24 hour day service demand at 1,000 revs. a minute. Corrosion fatigue and cracking was taking place at the leading edge and being transmitted round the blade which broke away, taking some of the other blades with it.

New ultrasonic pipeline testing set

Experiments were carried out on an impeller to establish the approach and exposure time, and then inspection was carried out. With a minimum inspection period of 5-6 hours, flaws were located almost as soon as they originated, eliminating possible breakdowns.

Range of Six Nickel-Chromium Alloys

The name Nimocast has been introduced by *Henry Wiggin and Co. Ltd.*, Wiggin Street, Birmingham 16, for a range of high temperature nickel-chromium base alloys for use in cast form. Six alloys are now available in the series, five of which were developed in the laboratories of the Mond Nickel Co. Ltd.

The series is as follows (earlier names in brackets):

Nimocast 75 (*formerly Nimonic C75*)—May be used under conditions involving low stresses, but requiring good resistance to oxidation. Does not respond significantly to heat-treatment and is normally used in the 'as cast' condition, or after a stress-relieving treatment.

Nimocast 80 (*formerly Nimonic CC*)—Has considerably higher room-temperature mechanical properties and creep-resistance than Nimocast 75. Used for gas-turbine stator blades and pre-combustion chambers of high-performance diesel engines. Normally used in the fully heat-treated condition.

Nimocast 90 (*formerly Nimonic CB*)—The casting version of Nimonic 90. Also responds to heat-treatment and is generally used in the age-hardened condition. It is preferable to Nimocast 80 for high-stress, high-temperature applications. At 750°C, shows stress-carrying capacity inferior to that of the corresponding wrought alloy, but at 870°C and above, is claimed to carry at least as high a stress for a given life as Nimonic 90.

Nimocast 242 (*formerly C242*)—Developed by Rolls Royce Ltd., for investment casting applications involving high resistance to thermal shock. Used in the 'as cast' condition at temperatures up to 1,050°C.

Nimocast 257 (*formerly MC57*)—Has properties intermediate between those of Nimocast 75 and Nimocast 90, giving adequate proof stress combined with good ductility at temperatures in the range of 600-700°C.

Nimocast 258 (*formerly MC58*)—A recently developed alloy which has good stress/rupture properties at temperatures higher than 950°C. Similar in composition to Nimonic 100, the most creep-resistant alloy of the Nimonic series. Is claimed to have the highest stress/rupture properties in the 'as-cast' condition.

Slurry Pump

The slurry pump manufactured by the *Pulsometer Engineering Co. Ltd.*, of Nine Elms Iron Works, Reading, is spindle-mounted on double ball and roller bearings and is designed to deal efficiently with most types of difficult water, including water containing abrasive solids such as sand, pyrites and coal ash.

Wear of impeller and sideplates can be adjusted without dismantling the pump, and although the pump has no renewable liner, the casing or volute, which is fitted with spigots registered for automatic alignment, can be readily replaced when worn out. These pumps are supplied in 2-14 in. standard sizes and cover a range of duty from 50-5,000 g.p.m. for heads up to about 60 ft.

The pump casing is close-grained cast iron steel, etc., of extra thickness, and in the large 12 in. and 14 in. sizes there is a renewable cut water which is in harder material than the casing, having covers so arranged that it can be examined and renewed without opening up the pump.

For particularly severe conditions where there is danger of corrosion in addition to abrasion, stainless steel is used for the construction especially when salt water is present, while for acid water, austenitic iron or non-ferrous alloys are employed.

Pneumerstat

The Pneumerstat, made by *Williams and James (Engineers) Ltd.*, Chequers Bridge, Gloucester, is claimed to combine the duties of a bubbler chamber, pressure reducing valve and needle valve for use in applications to control the supply of compressed air when this is used for the indication of content, level or pressure.

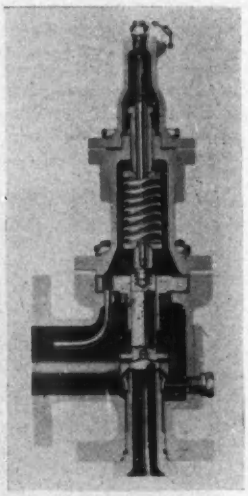
Other uses include the regulation of a slow feed of water for laboratory tests and the continuous sampling of gas for analysis of shed atmosphere and absorption tower outlets.

Williams and James also manufacture pressure reducing valves and relief valves together with a range of oil-free compressors.

Safety Valves

Safety relief valves, type 1900, for the chemical and oil industries, made by *Dewrance and Co. Ltd.*, Great Dover Street, London SE1, are of the full nozzle, high-lift, high capacity variety and are suitable for petroleum liquids, gases and vapours. A new feature in the standard valves is the addition of an eductor tube, designed to allow pressure within the bonnet to be withdrawn into the discharge stream faster than it is possible for it to enter through the guide clearance, thus allowing only the force exerted by the spring to control the valve.

The single ring blow-down adjustment controls blow-down only and does not affect rated capacity of the valve. The fixed secondary orifice dimensions cannot be altered, ensuring a constant high capacity, regardless of adjustments that are made, or neglected on the plant. Alternative design with bellows is available, suitable for operating against maximum variation in back pressure while maintaining high capacity, set pressure and characteristic blow-down.



Dewrance consolidated safety release valve, 1900 Rediweld polythene stopcock

Stability of the bellows during discharge conditions is assisted by the internal guide. Components of the two types are interchangeable, enabling

standard valves to be converted to the bellows type on site. The valves have carbon or alloy steel bodies and stainless steel trim.

PVC Filter Material

The new Rhovyl filter material, developed by *Rediweld Ltd.*, Kelvin Way, Crawley, is based 100 per cent p.v.c. fibres. These filters are said to stand up to 96 per cent sulphuric acid up to 40°C, 90 per cent sulphuric acid up to 60°C, concentrated nitric acid up to 60°C, concentrated hydrofluoric acid up to 50°C,

Rediweld moulded polythene stopcock

concentrated hydrochloric acid up to 60°C, and 40 per cent sodium hydroxide and 40 per cent potassium hydroxide, both up to 60°C. For lower concentrations of acids and alkalis, the filters can be used at temperatures of up to about 100°C.

Filtration of substances which require organic solvents is limited by the fact that some attack p.v.c. or 'swell it.' The filters are not liable to attack from bacteria, etc. Their mechanical strength in the wet state amounts to 2,250 p.s.i. and in the dry state, to 2,100 p.s.i. The material is available in rolls up to 36 in. width in various sizes of sheets as well as discs of standard diameter.

A new moulded polythene stopcock is also produced by the firm. Intended for the outlets of polythene vessels, it is fitted with a screwed male section. A moulded taper section is designed to give a tight fit at the valve seating. These stopcocks may be used for pressures up to about 15 p.s.i. Bore is $\frac{7}{16}$ in. by 4 in. high.

Filter with Diatomite Precoat

A Stellar filter which has a precoat of diatomite (Kieselguhr or diatomaceous earth) is in production by *Paterson Engineering Ltd.*, Windsor House, Kingsway, London WC2. Designed primarily for the removal of fine suspensions or hazes it consists of a pressure vessel divided by a diaphragm plate which supports the filter elements. The upper portion is the outlet chamber, the lower body portion the inlet chamber, into which the elements project downwards from the element plate. The filtering elements usually consist of fluted tubes, wound with a wire across the tips of the flutes, the wire being laid in grooves made by forming a screw thread along the elements, which make a support for the filter bed or precoat.

A unique feature claimed for the Stellar filter is the Autopact cleaning. Air spaces are provided in the body in both compartments, and when cleaning takes place the outlet valve is closed; the pumping continues compressing the air in both compartments, and the pressure is locked in by closing the inlet valve. When the body chamber air is suddenly released by a quick opening valve, the outlet chamber air expands forcing clean liquid in the reverse direction through the elements and dislodging the precoat with its deposits.

An advantage claimed for this type of filter is that the process is carried out without the liquid being exposed, and in most cases the sludge discharge can be piped away. The filter can be used for removing iron sulphide sludge from diethanolamine solution in oil refineries, for the filtration of hot caustic washing solution and the fine filtration of synthetic lacquers in the paint industry, the filtration of ammonium citrate in the pharmaceutical industry.

Combustion and Atomising Equipment

Equipment supplied by *Urquhart's (1926) Ltd.*, 5 Wadsworth Road, Perivale, Greenford, Middlesex, has been used in plant design by many well-known chemical companies. Two high duty combustion chambers (HDCC) are in use by Imperial Chemical Industries, one in a caustic fusion and the other at a sulphate plant. ICI are also using a medium pressure air atomiser (MPA) in a reformer plant and in a Nitro-chalk plant. HDCC equipment is also being used by Tate and Lyle, Marchon Products and Unilever and MPA by Power Gas Corp.

Urquhart's have concentrated on heat release and combustion problems associated with the conversion of coal or gas fired plant to oil firing. Atomisers are constructed according to a principle of atomisation based on the physical phenomena of the vortex ring. It is claimed that much higher jet velocities can be used, thus saving pre-heating costs with the heavier grades of fuel.

Broadbent Developments

Thomas Broadbent and Sons Ltd., Central Ironworks, Huddersfield, have in an advanced state of development a new centrifugal to meet the needs of the chemical processing industry. Mounted on a three-point suspension to minimise vibration, it has a variable speed drive, bottom discharge and a discharging plough.

In addition to the above, further developments are being made on large horizontal ploughing centrifugals in which the maximum amount of standardisation is being incorporated.

Electronic Scale

A scale that can deliver reasonably free-flowing granular or powdered materials at a constant pre-determined rate by weight is manufactured by *W. and T. Avery Ltd.*, Soho Foundry, Birmingham 10. Two or more of these scales are suitable for feeding ingredients, in constant proportions, in a continuous process.

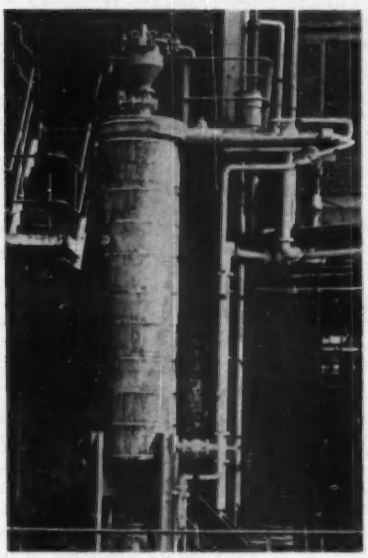
Accuracy of the scale is based on test weighings taken over three-minute intervals and ranges from $\pm \frac{1}{2}$ per cent upwards according to the nature of the material being handled. Generally the accuracy is reduced when lumpy or non-free flowing materials are used and the scale is not sujtable for material in which there are large lumps.

Material is fed continuously from a suitable source of supply into the hopper on the scale, from which it is withdrawn, through a gate opening, by a moving feed belt. The material is transferred from the feed belt to the moving weigh belt, which is mounted on a scale, and upon which the material is weighed. The scale is fitted with a 'light and heavy' indicator head, and an electronic switch, which controls the size of the gate opening in the hopper so that a constant weight of material is maintained on the weigh belt. This is demonstated by the indicator remaining at zero.

The scale is made in two sizes and each is provided with means of changing the belt speed over the range 200, 400, 600, 800, 1,000 weigh lengths per hour. The scales are normally wired for 400/440 volts 3 phase 50 cycle electrical supply.

Plant to Remove H_2S from Gases

A recent development of *Robert Dempster and Sons Ltd.*, Rose Mount Iron Works, Elland, Yorks, is the introduction of a plant for the removal of hydrogen sulphide from industrial gases by means of pelleted oxide of iron. The plant is so designed, the makers claim, that complete flexibiljty is obtained, the



A tower for H_2S removal from gases, installed by Robert Dempster for the removal of 9 grains of H_2S per 100 cu. ft. from inert gas

throughput of pellets being directly related to the total burden of the hydrogen sulphide in the gas, irrespective of its volume. The process employed allows extraction down to 1 p.p.m. of the hydrogen sulphide.

Chemical Plant and Equipment

A small plant has been installed recently by the company at a works for the removal of 9 grains of hydrogen sulphide per 100 cu. ft. from 8,000 cu. ft. inert gas used for producing synthetic varnish for paint manufacture.

Flexible Furnace

For application where large areas have to be subjected to high temperatures, *Electrothermal Engineering Ltd.*, 270 Neville Road, London E7, have developed the

Heat-by-the-Yard applied to the rocking container of a hydrogenator. (By courtesy, Whiffen and Sons Ltd.)

flexible furnace. This heavy duty heater is built up from a network of resistance wires insulated by specially constructed interlocking high temperature resistant ceramic blocks. Designed to have a surface loading of up to 50 w/sq. m. (7.75 w/cm.^{2}) controlled temperatures of up to 1,000°C are obtainable.

By its construction, a high degree of flexibility is allowed so that heaters can be applied to parts having a small diameter (e.g. ½ in.). Rectangular heaters can be supplied in sizes up to 48 in. x 48 in.

The GNL Nitroneal Generator

The *Baker Platinum Division of Engelhard Industries Ltd.*, 52 High Holborn, London WC1, have produced a new model of their Nitroneal generator—an apparatus which produces furnace and blanketing atmospheres, consisting of nitrogen with a controllable hydrogen content, using ammonia as fuel. The GNL Nitroneal generator is made in two sizes to produce 500 and 1,500 cu. ft. per hour of gas, it has a built-in vaporiser and it is fed with liquid ammonia direct from the cylinders. The refrigerant properties of the ammonia are used to cool the gas down to a dew-point of 40°F.

The gas is produced by cracking the ammonia over a precious metal catalyst into its constituents nitrogen and hydrogen, and the same catalyst is used to burn the bulk of the hydrogen with atmospheric oxygen to produce a gas containing from 0.5 to 25 per cent hydrogen. The principal advantages claimed for using the catalyst in this way are that the reaction is exothermic and no external heat source is required, and that in utilising nitrogen from the atmosphere as well as from the ammonia the gas is produced very economically.

In the GNL model, a second stage catalyst chamber is used when the hydrogen concentration required is less than 15 per cent and this further change in design is stated to prolong the life of the catalyst. It also ensures that the oxygen content of the gas is less than one part per million.

Chemical Resisting Paints

Two new chemical resisting paints based on the Shell Epikote (epichlorhydrin) resins have been developed by *Detel Products Ltd.*, Victoria Park Estate, South Ruislip, Middlesex. These are Detel S and Detel 'AD,' which are stated to show excellent resistance to acid, alkali and solvents, combined with good adhesive properties and hardness.

Detel 'AD' is being used by manufacturers of chemical equipment, in particular, the manufacturers of centrifuge plant handling various types of chemical and solvent. With Detel AD a hard decorative chemical resisting finish is obtained, Detel Products claim. This paint is not recommended for water resistance on metallic surfaces.

Detel 'S' is recommended for application to any material which is stable to the storing temperature at 205°C (400°F) for up to 30 minutes. A primer, 'S' chromate primer, is suggested for use on ferrous metals or aluminium surfaces.

Tray Belt Filter

The Nordengren tray belt filter, manufactured by the *Sturtevant Engineering Co. Ltd.*, Southern House, Cannon Street, London EC4, has been designed to overcome the limitation of the earliest type of continuously-working vacuum filter. It is particularly suitable where the liquid rather than the solid contains the values and the cake thickness can be varied to obtain optimum conditions irrespective of the initial sludge density.

The Nordengren horizontal tray belt filter consists of a series of trays or boxes connected together to form the links of an endless chain. Each tray is fitted with a perforated plate bottom over which a filter cloth is stretched. The selection of this cloth is of great importance and is varied according to the sludge-solid particle size and the pH of the sludge-liquid. The sludge or pulp is fed by means of a special rotary feeder which provides the correct loading to each tray; the rotation of the feeder and the forward movement of the trays are synchronised.

The liquid passes, through the filter cloth and thence through the suction box to the 'barometric tubes' and by way of hydraulic seals to the collecting tanks, or to waste. The filter cake is discharged as each tray inverts at the discharge end of the plant.

Filtration is accomplished by the same principle as that employed by the Büchner apparatus. On the underside of each tray, a rubber tube connects with an endless rubber suction belt which slides over the suction box and is actuated by lugs on the trays; this ensures synchronous movement by the belt and the trays. The suction box beneath the rubber belt is connected to a vacuum system; it is divided into sections so that if necessary, the main filtrate and the subsequent washings may be recovered separately.

The plant may be used for every kind of material including those containing acids; when designed for this duty it is usual to construct in acid-resisting materials and all containers are rubber-lined.

Chemical Resistance of Pure Tantalum

PURE tantalum is a ductile metal with a specific gravity of 16.6 and a melting point of 3,000° C. It possesses an exceptional resistance to the attack of the strongest acids. Above all, processes involving hydrochloric acid, nitric acid or a mixture of both can be carried out in tantalum equipment up to a temperature of between 250 and 300° C. The corrosion resistance to concentrated sulphuric acid and 85 per cent phosphoric acid attack is somewhat less, but is excellent up to temperatures of about 150°C, state *New Metals and Chemicals Ltd.*, 16 Northumberland Avenue, London WC2, UK agents for W. C. Heraeus GmbH.

The corrosion resistance of tantalum is due to a thick and tough layer of tantalum oxide on the surface of the metal. Hydrofluoric acid dissolves tantalum oxide and consequently cannot be used in connection with tantalum. There is no attack up to 150° C by acetic acid, dry or wet chlorine, organic chlorine compounds, bromine or hydrobromic acid. Nascent hydrogen which is easily picked up is dangerous as it leads to the formation of hydride and consequently to the embrittlement of the tantalum.

In spite of its high melting point the limits of temperatures at which tantalum can be safely used are given as 250-300° C. Above these temperatures it picks up oxygen, which causes an increase of hardness leading to embrittlement of the material.

Tantalum can be welded by means of an electric arc process with oxygen and nitrogen excluded. It can also be electrically spot-welded.

Applications of tantalum are being steadily developed and expanded, but the metal has already won an important place, mainly in the organic and pharmaceutical industries.

Reprints of New Plants Feature

The exclusive 4-page "Chemical Age" feature on new UK chemical plant projects, pages 492-495 of this issue, is being reprinted. Requests for copies of this, which are free of charge, should be made to the Manager, "Chemical Age," 154 Fleet Street, London EC4.

PRAGUE SYMPOSIUM ON MACROMOLECULAR CHEMISTRY

AN international symposium, covering the physics and physical chemistry of macromolecules, polymerisation and the reactions of polymers, was held in Prague, under the auspices of the International Union of Pure and Applied Chemistry and the Czechoslovak Academy of Science, from 9 to 15 September. Institutions from more than 20 countries were represented and over 150 original papers were given, in addition to lectures reviewing recent advances in different fields. Although the papers dealt with fundamental aspects many were related to industrial processes.

One of the main symposium lectures, given by Professor H. Mark (Polymer Research Institute, Brooklyn), reviewed new polymers likely to be of industrial value. These included Viton A, a copolymer of fluorinated ethylene and fluorinated propylene, which is rubber-like in character and unaffected by most solvents, polyformaldehydes of high crystallinity, Lexan, a stiff chain polycarbonate, which when cross-linked has considerable rigidity and strength and polymers derived from pentaerythritol which are soluble in chlorinated hydrocarbons and are suitable for lacquers. Professor Mark also discussed the modification of such polymers as cellulose by grafting other polymers to their chains.

Phase Transitions

The first group of papers included review lectures by Professor Muller (Marburg) on deformation and by Professor Kargin (Moscow) on phase transitions. Original papers were given on cold drawing (Lazurkin, Moscow), relaxation and dielectric loss (Mikhailov, Leningrad; Kepes, France), the rate of diffusion of solvents in polymers (Bisschops, Belgium) and transition temperatures (Rybnikar, Czechoslovakia).

Papers on the properties of solutions included contributions on light scattering, streaming birefringence, fractionation and methods of determining molecular weights. Among the latter was one by Drs. Majury and Leherle (British Celanese) describing an ebullioscopic method for the determination of the molecular weights of polyamides.

A large number of papers were concerned with polymerisation. These included contributions on recent developments in the polymerisation of caprolactam (Saunders, British Nylon Spinners; van der Want and Kruissink, Delft), condensation polymerisation and the roles of ions and radicals in polymerisation. Aromatic polyanhydrides, a new class of high melting fibrous polymers, were described by Dr. Conix (Belgium).

A number of papers were concerned with the effects of ionising radiations on polymers and polymerisation processes. Others dealt with the formation of block and graft polymers and included one by Dr. Akutin (Moscow) on the use of ultrasonics. Professor Ziegler (Mulheim) reviewed the use of organo-metallic complexes in the production of stereospecific polymers. Depolymerisation and degradation were reviewed by Professor Simha (New York) and papers on this topic included a contribution by Drs. Grassie and McNeill (Glasgow) on the depolymerisation of polymethylacrylonitrile.

Biological polymers were reviewed in a main lecture by Professor P. Doty (Harvard) and there were a number of contributions on proteins and nucleic acids. In one of these Dr. Huggins (Rochester, N.Y.) reviewed the principles of protein and polypeptide structure. Papers on polysaccharides included one by Professor Rogovin (Moscow) on the synthesis and properties of tricarbonates of cellulose and phenyl esters of cellulose. Others dealt with the fractionation of benzyl cellulose (Goncharov, Kiev) and the estimation of the molecular weights of celluloses (Marx, Mainz). Inorganic polymers were reviewed by Professor Thilo (Berlin) and there were several papers dealing with polymers based on phosphorus and silicon.

The organisation of the symposium, by Czechoslovak chemists, was extremely good. Language difficulties, inevitable in such a meeting, were almost completely overcome by the provision of preprints and the simultaneous translation of speakers remarks into English, French, Czech, Russian and German.

Such discussion, with the original papers, will be published in the *Journal of Polymer Science*. Review lectures will be issued as a separate volume by the Czechoslovak Chemical Society. The exchange of views between participants, both in formal and informal discussion, cannot fail to stimulate progress in polymer chemistry, both fundamental and applied.

W. R. MOORE

Colouring of Man-made Fibres

'RECENT advances in the colouring of man-made fibres' was the title of a symposium organised by the Society of Dyers and Colourists and held at the Palace Hotel, Buxton, on the 18, 19 and 20 September.

Attendance, which is believed to have been a record for any symposium organised by the society, was noteworthy for the attendance of visitors from the Soviet Union and Japan, as well as East European, West European countries, and the US. Indeed, it was one of the most truly international conferences ever in the long history of the society.

The conference was opened by Mr. Clifford Paine, B.Sc., F.R.I.C., F.S.D.C., president of the society and director of Imperial Chemical Industries Ltd. The opening address was by Mr. A. H. Wilson, F.R.S., a managing director and director of research, Courtaulds Ltd.

The opening lecture was 'Azo dyes from substituted 2-aminothiopens' by J. B. Dickey, E. B. Towne, M. S. Bloom, W. H. Moore, B. H. Smith Jr., and D. G. Hedberg (all from the research laboratories, Tennessee Eastman Co., Kingsport, Tennessee, US).

Probably the best-attended of the sessions were those dealing with the dyeing of the new acrylic fibres. The first address in this field was that by J. Khachoyan and J. P. Niederhauser (Compagnie Francaise des Matieres Colorantes Villers, Saint-Paul, France) who discussed, 'A new method for the high-temperature dyeing of acrylic fibres' after which K. Meldrum and J. S. Ward (research laboratories, Courtaulds Ltd., Droylsden, Manchester), spoke on 'Some aspects of the dyeing of acrylic fibres, with particular reference to the pack-dyeing of Courtelle.'

From the US came Mr. W. H. Hindle (The Chemstrand Corporation, Decatur, Alabama), to talk on 'The union dyeing of acrilan-wool blends' and Mr. G. H. Lister (Sandoz Products Ltd., Bradford) discussed 'Dyeing of acrilan and wool-acrilan blends.'

Discussion at these sessions was prolonged and few of the 380 delegates were absent.

Details of the new work being carried out at Leeds University on the dyeing of the hydrophobic fibres in solutions and solvents were given by Dr. L. Peters, Dr. C. B. Stevens and M. K. Gokhale. Earlier, W. Luck from the Badische Anilin-und Soda-Fabrik, A G, Ludwigshafen, Germany, had spoken on 'The mode of action of non-ionic levelling agents'.

Dr. E. Atherton, Mr. D. A. Downey, both of Imperial Chemical Industries Ltd., and Professor R. H. Peters of the College of Science and Technology, Manchester, spoke on observations on the dyeing of nylon with mixtures of acid dyes, after which H. W. Peters and J. C. Turner (British Nylon Spinners Ltd.) addressed the symposium on 'Investigations into the dyeing of continuous-filament nylon with disperse and anionic dyes'.

For the last day, A. S. Fern and W. F. Liquorice (Imperial Chemical Industries Ltd.) gave details about new pilot plant machines used for the flash-ageing of vat-printed viscose rayon fabrics, in what is understood to have been the first lecture on this subject in Britain: Dr. H. B. Hallows (Courtaulds Ltd.) and Mr. H. A. Turner (College of Science and Technology, Manchester) discussed 'The migration of dyes in the fibre-substance during steaming'.

'The colouring of Vinylon' was another address which attracted no little interest, in view of S. Nomura and K. Tanabe (Kurashiki Rayon Co., Ltd., Osaka, Japan) being the speakers. Not the least interesting in the programme was the way in which the two Japanese answered the questions. Indeed, their grasp of English surprised not a few! They had a difficult assignment but they dealt with it magnificently.

J. A. Fowler and C. Preston (Imperial Chemical Industries Ltd.) lectured on 'The application of reactive dyes to viscose rayon' (another full house here) and then for the final session there was a new innovation—a 'Colloquium on high-temperature dyeing' which proved exceedingly successful, perhaps because of its essentially practical nature.

Mr. Fred Smith (Wm. Smith and Co., Ltd., Bruntcliffe near Leeds) dealt with 'The high-temperature dyeing of Terylene slubbing or loose stock', Mr. H. R. Hadfield and R. Broadhurst (Imperial Chemical Industries Ltd.) spoke on 'The high temperature disperse dyeing of Terylene polyester fibre', J. Fowler and K. Walsh (William Tatton and Co., Ltd., Leek) 'Some practical aspects of the high-temperature dyeing of continuous-filament yarns of man-made fibres' and finally, H. R. Hadfield and H. Seaman (Imperial Chemical Industries Ltd.) considered 'The dyeing of nylon with acid and chrome dyes at high temperatures'.

Overseas News

POLISH SULPHURIC ACID WORKS TO USE NATURAL SULPHUR DEPOSITS

PLANS are being drawn up for the erection of a sulphuric acid works at Torun (north Poland) to help in the exploitation of the large sulphur deposits discovered a few years ago at Tarnobrzeg. This will be the first factory in Poland producing sulphuric acid from natural sulphur rather than from pyrites. The works will be attached to the Torun Phosphorus Fertiliser Combine, and building is scheduled to start next spring. The factory should be finished at the end of 1959, and production will begin even before actual completion, in the autumn of 1959.

In view of Poland's lack of previous experience of this form of sulphuric acid production, the basic equipment will be bought from France. A recently concluded agreement covers provision of documentation, installations and automatic controls by a French firm, on a credit basis. Those parts of the installations of which Polish industry already has experience will be produced in Poland.

The greater part of the processes will be conducted in the open, and the heat produced from the combustion of the sulphur will be used to make technological steam, with consequent coal economies.

The Torun works will act as a pilot plant for the sulphuric acid works to be built later at Tarnobrzeg as part of the combine that is planned at the actual site of the deposits.

Czech Plant Projects

Two industrial projects described as among the largest of their kind in Europe are being undertaken by Czechoslovakia. One is a gas works situated on the River Elbe, near the East German Frontier which will process low grade lignite from nearby mines. It is planned to produce 475 million cubic metres of gas annually and as by-products, 100,000 tons of tar, crude oil and other chemicals a year. Construction of the plant started this month. It is scheduled to be completed by 1961.

The second project is for a new magnesite quarry near the Russian border. Deposits according to estimates are of the order of 100 million tons of the highest quality. Further deposits are still being located, it is stated.

Higher Japanese Output of Chemical Fertilisers Expected

Output of the Japanese chemical fertiliser industry is expected to total 3.8 million tons during the fertiliser year ending July 1958, state the Japanese Ministries of Agriculture and Forestry and of International Trade and Industry. This would be an increase of about 500,000 tons over the year ended July 1957. It is estimated that domestic demand will amount to 2.6 million tons and export demand to 1.2 million tons. Principal markets are Formosa and Korea.

Competition from western countries is expected to be keener as a result of the decline in ocean freight rates during the past few months. The prices at which recent contracts have been concluded range from £20 15s to £22 3s ton f.o.b., compared with £23 a year ago.

Superphosphate Plant Opened in India

A new Indian plant for the manufacture of superphosphate and sulphuric acid has been opened in Madras. The plant will produce 33,000 tons of superphosphate a year, over half the target set by the Planning Commission for the year.

Italian Sulphur Exports 88 per cent Increase

During the period August 1956 to July 1957, 117,690 metric tons of sulphur were marketed in Italy. Figure for the previous 12 months was almost the same (117,690). Exports in the same period have increased by 88 per cent, from 91,576 tons to 172,987 tons.

Principal buyers of Italian sulphur are: France (51,445 tons), Israel (35,420 tons), Russia (24,206 tons), Tunisia (22,640 tons), Sweden (7,580 tons), Yugoslavia (6,923 tons) and Czechoslovakia (5,102 tons).

Pakistan Plant to Make Rayon and Cellophane

The Pakistan Industrial Development Corporation is co-operating with a Pakistan firm in the planning of a Rs75 million plant near Karachi to make rayon and cellophane. A Japanese chemical firm is to act as technical consultant. Plans call for a daily capacity of 10 tons of rayon yarn and 5 tons of cellophane, sufficient to meet Pakistan's needs. Work on the project will start soon and the plant is scheduled to go into production in 1959.

Du Pont Offers Sodium Cyclamate

Sodium cyclamate is now being offered by E. I. Du Pont de Nemours Co. Inc., US, as a companion product to its Cyclan calcium cyclamate—the non-nutritive sweetener. The sodium salt has been developed for use in systems which can take calcium, i.e. systems with such ingredients as phosphates, tartrates and oxalates.

Indian Drawback on Dichromates

The Indian Government has directed that drawback should be allowed of duty paid soda ash of the heavy variety used in the manufacture of dichromates when manufactured in and exported from India, or shipped as stores for use on board ships sailing to foreign ports. Products affected are: sodium dichromate dihydrate; anhydrous sodium dichromate; potassium dichromate; ammonium dichromate; chromic acid.

Freon Gas Plant Opened in Brazil

Du Pont do Brasil, SA, Industrias Quimicas, has recently opened a Freon gas plant between Sao Paulo and Rio de Janeiro, at Goiabal, near Barra Mansa. Carbon tetrachloride needed in its manufacture has still be be imported but it is hoped that it will become available locally within about a year. A number of by-products will also be manufactured at the new plant.

Hüls Synthetic Rubber Plant Operating

Trial runs have begun at the £13 million synthetic rubber plant of Chemische Werke Hüls. Full operation is scheduled for next summer.

Annual capacity of the plant is stated to be 45,000 tons of butadiene rubber, but the plant has been designed so that the capacity can be increased by 15 to 20 per cent. It is believed that the Hüls synthetic rubber will sell at DM2.65 per kilo compared with the US price of DM2.55.

German tyre manufacturers are understood to have pledged to underwrite losses which the new plant may incur up to an annual amount of £850,000 for a period of five years.

Synthetic Detergent Plants in India

The first large-scale synthetic detergent plant in India has been installed by the Swastik Oil Mills at Bombay, and a second detergent plant is to be set up by Hindustani Levers in a few months. The Indian Government plans to set up a National Development Council for the oil, paint and soap industries.

Dutch Firm Reports Higher Calcium Carbide Profit

The Dutch Chemical concern of N. V. Electro Zuur-en Waterstoff-fabriek, Amsterdam, report intense activity during the financial year that ended in April 1957. Output of calcium carbide was 44,000 tons (39,500 tons) and other products marketed during the year include dissolved acetylene, compressed and liquefied gases and acetic acid. 1.2 million florins (approx. £120,000) were invested in the company, and their financial turnover was 26 million florins (approx. £260,000), compared with 23 million florins (approx. £230,000) for the previous year. Operating surplus amounted to 2.67 million florins (approx. £267,000) and a dividend of 12 per cent was paid to shareholders. A new steam boiler and oxygen plant will start operating in the near future.

Holland Electro Chemical Industries (Pty.) Ltd., Johannesburg, in which the Dutch concern has an interest, reports an increase in turnover. All departments are said to have worked to capacity during the first months of the new financial year, and results were better than in the corresponding months of the previous year. A staff of 672 were employed at the end of April 1957.

PEOPLE in the news

● PROFESSOR E. G. COX, Professor of Inorganic and Structural Chemistry at Leeds University and a past vice-president of the Institute of Physics, who has published many scientific papers on the crystal structures of chemical compounds, has been appointed to a vacancy on the Agricultural Research Council. He and PROFESSOR T. A. BENNET-CLARK are filling vacancies on the Council caused by the retirements of PROFESSOR E. J. MASKELL and PROFESSOR L. P. PUGH. PROFESSOR P. B. MEDAWAR has been reappointed for a further term. Professor Cox has said that his interests are mainly concerned with soil and plant life and he welcomes this opportunity of a new additional association with agricultural husbandry. He is a native of Somerset and belongs to a family which had strong farming links for four generations. He graduated at the University of Bristol and was at Birmingham University before he went to Leeds.

● MR. G. M. HARVEY has been appointed managing director of British Oxygen Wimpey Ltd. He relinquishes his appointment on the company's board as design manager.

● MR. HUMPHREY G. ROPE, director of Fisons Ltd., Harvest House, Felixstowe. has been elected chairman of the Superphosphate Manufacturers' Association for 1957-58. MR. F. M. STEVENS, chairman of the Sheppy Glue and Chemical Works Ltd., Horley, has been elected vice-chairman.

● MR. J. G. SMITH (left), director, Courtaulds Ltd. and MR. G. WAGGETT (right), works manager, seen examining a

J. G. Smith (left) with G. Waggett

cone of the new fluorescent yarn at the opening of Courtaulds, new textile development unit at Arrow Hill, Rochdale.

● A delegation from the British Coke Research Association, headed by MR. LESLIE O'CONNOR, chairman, and MR. G. W. LEE, a director, left Britain on 20 September for a four-weeks' tour of the US. They will visit coke oven plants, iron and steel works, and research organisations and laboratories.

● Four new appointments have been made to the home sales staff of Fielden Electronics Ltd. MR. A. R. BLANCHARD is appointed manager of the new industrial electronics division. Two new technical representatives, MR. F. G. TOTTY (Yorkshire) and MR. R. SHAW (East Lancashire), have also been appointed and MR. K. ADAMS has taken over statistics and market research.

● MR. WILLIAM COLLISON has been appointed chairman of William Blythe and Co., and also of John Riley and Sons, in succession to the late Mr. F. E. F. BLYTHE.

● DR. HERMAN HOLZRICHTER of Leverkusen and DR. KURT WILHELM SCHNEIDER of Hamburg have been appointed managing directors of the newly formed joint Bayer-BP company, Erdoelchemie G.m.b.H. (see CHEMICAL AGE, 21 September, p. 454).

● COMMANDER MICHAEL B. ST. JOHN, D.S.C., R.N. (Retd.), has been appointed managing director of Liquid Systems Ltd., Norwich Union House, Wellesley Road, Croydon who manufacture the Bowser range of industrial equipment with Rubery Owen and Co. Ltd. He joined Liquid Systems Ltd., after intensive training and experience in industry.

● Deputy chairman and managing director of British Glues and Chemicals Ltd., MR. HAROLD J. COTES, has now been appointed chairman. He succeeds SIR ROGER DUNCALFE, who has resigned as chairman and from the board on medical advice. MR. D. R. ASHWORTH, who has been technical controller of the company since 1946, has been appointed a director.

● DR. K. G. A. PANKHURST, of the British Leather Manufacturers' Research Association, has been nominated to fill the vacancy at the Royal Institute of Chemistry caused by the retirement of the vice-chairman, MR. F. C. HYMAS. MR. P. F. CORBETT, the hon. treasurer, has been re-nominated for another year, and DR. S. A. MILLER is standing as hon. secretary, following the retirement of MR. A. J. TURNBULL. Dr. Miller's nomination has caused a vacancy for an hon. assistant secretary, and MR. G. C. ACKROYD has been nominated for this post. The annual meeting will be held at the Royal Society of Health, 90 Buckingham Palace Road, London SW1, on Wednesday, 20 November at 6.30 p.m. After the business meeting there will be a discussion which the president, PROFESSOR W. WARDLAW, C.B.E., hopes to attend.

● MR. H. DRIVER, secretary and alternate director of Monsanto Chemicals Ltd., Victoria Street, London W1, has been appointed to the board. He will continue as secretary and head of the legal department. As an executive director he will also be responsible for insurance, Monsanto House administration and in conjunction with the chairman, SIR MILES THOMAS, new financing.

● MR. P. S. RENDALL has resigned as chairman of Lustre Fibres in order to devote more time to other duties, which include a deputy chairmanship and a joint managing directorship of Courtaulds Ltd. He is also chairman of British Nylon Spinners Ltd. MR. D. RAWLINSON, managing director, becomes chairman of Lustre Fibres, who are overseas distributors of Courtaulds' yarns, fibres and plastics and of BNS nylon yarns and fibres.

30th World Congress of Industrial Chemistry

SCIENTISTS from 22 countries of both east and west have been attending the 30th International Congress on Industrial Chemistry which opened in Athens on 18 September. The congress lasted for one week. It was reported that more than 100 scientific reports were to be made in committee. The congress was organised by the Greek Chemical Association.

Chairman of the organisational committee, Professor Delyannis of Athens, stated that practical uses of solar energy would be emphasised, as the sun was the source of energy for the future, because of its advantages over nuclear energy: accessibility to most countries; it could not be exhausted; and it did not contain any dangerous fallout.

A display of the uses of solar energy for industrial purposes, previously on show at the US pavilion in the Salonika international fair, was set up in Athens for the benefit of those attending the congress.

Courtaulds to Continue Protein Fibre Production

FOLLOWING the announcement by Imperial Chemical Industries Ltd. that ICI's Ardil (protein fibre) will not be produced, Courtaulds Ltd., affirm that they are to continue to produce Fibrolane, Courtaulds' protein fibre. General sales manager of the group, Mr. J. G. Smith stated, during a press conference prior to the opening of Courtaulds' new textile development unit at Arrow Mill, Rochdale, on 19 September, that the company had not the 'slightest intention' of giving up their work on Fibrolane. 'We are hopeful about the future and are a long way from ceasing production—in fact, just the reverse.'

The development unit, the cost of which is likely to be over £400,000 when final modifications have been completed, contains a unique assembly of machinery for spinning, processing, knitting, weaving and carpet tufting of all types of man-made staple fibres, used singly, together or in blend with natural fibres.

The development unit is at the disposal of the textile trade as a whole, offering a service of examination and report.

BRITISH CHEMICAL PRICES

GENERAL CHEMICALS

Acetic Acid. D/d in ret. barrels (tech. acid barrels free); in glass carboys, £8; demijohns, £12 extra. 80% tech., 10 tons, £97; 80% pure, 10 tons, £103; commercial glacial, 10 tons, £106.
Acetic Anhydride. Ton lots d/d, £136.
Alum, Ground, f.o.r., about £25.
MANCHESTER: Ground, £25.
Aluminium Sulphate. Ex-works, d/d, £15 10s.
MANCHESTER: £16 to £18 10s.
Ammonia, Anhydrous. Per lb., 1s 9d to 2s 3d.
Ammonium Chloride. Per ton lot, in non-ret. pack, £30 2s 6d.
Ammonium Nitrate. D/d, in 4-ton lots, £31.
Ammonium Persulphate. Per cwt., in 1-cwt. lots, d/d, £6 13s 6d; per ton, in min. 1-ton lots, d/d, £123 10s.
Ammonium Phosphate. Mono-and di-, ton lots, d/d, £106 and £97 10s.
Antimony Sulphide. Per lb., d/d UK in min. 1-ton lots: crimson, 4s 7d to 5s 0½d; golden, 2s 10½d to 4s 3½d.
Arsenic. Ex-store, £45 to £50.
Barium Carbonate. Precip., d/d, 4-ton lots, bag packing, £41.
Barium Chloride. 2-ton lots, £49.
Barium Sulphate [Dry Blanc Fixe]. Precip. 2-ton lots, d/d, £35.
Bleaching Powder. Ret. casks, c.p. station, in 4-ton lots. £30 7s 6d.
Borax. Ton lots, in hessian sacks, c.p. Tech., anhydrous, £66; gran., £45; crystal, £47 10s; powder, £48 10s; extra fine powder, £49 10s; BP, gran., £51; crystal, £56 10s; powder, £57 10s; extra fine powder, £58 10s. Most grades in 6-ply paper bag, £1 less.
Boric Acid. Ton lots, in hessian sacks, c.p. Tech., gran., £74 10s; crystal, £82 10s; powder, £80; extra fine powder, £82; BP gran., £87 10s; crystal, £94 10s; powder, £92; extra fine powder, £94. Most grades in 6-ply paper bag, £1 less.
Calcium Chloride. Ton lots, in non-ret. pack: solid and flake, £16.
Chlorine, Liquid. In ret. 16-17-cwt. drums d/d in 3-drum lots, £40.
Chromic Acid. Less 2½%, d/d UK, in 1-ton lots, per lb., 2s 2¾d.
Chromium Sulphate, Basic. Crystals, d/d, per lb., 8½d; per ton, £79 6s 8d.
Citric Acid. 1-cwt. lots, per cwt., £10 15s.
Cobalt Oxide. Black, per lb., d/d, bulk quantities, 13s 2d.
Copper Carbonate. Per lb., 3s 6d.
Copper Sulphate. F.o.b., less 2% in 2-cwt. bags, £75 2s 6d.
Cream of Tartar. 100%, per cwt., about £11 12s.
Formaldehyde. In casks, d/d, £37 5s.
Formic Acid. 85%, in 4-ton lots, c.p., £86 10s.
Glycerine. Chem. pure, double distilled 1,260 s.g., per cwt., in 5-cwt. drums for annual purchases of over 5-ton lots and under 25 tons, £10 1s 6d. Refined pale straw industrial, 5s per cwt. less than chem. pure.
Hydrochloric Acid. Spot, per carboy, d/d (according to purity, strength and locality), about 12s.
Hydrofluoric Acid. 60%, per lb., about 2s 6d per lb.
Hydrogen Peroxide. Carboys extra and ret. 27.5% wt., £128 10s; 35% wt., d/d, £158.
Iodine. Resublimed BP, under 1 cwt., per lb., 14s 4d; for 1-cwt. lots, per lb., 13s 5d.

These prices are checked with the manufacturers, but in many cases there are variations according to quality, quantity, place of delivery, etc.

Abbreviations: d/d, delivered; c.p., carriage paid; ret., returnable; non-ret. pack., non-returnable packaging; tech., technical; comm., commercial; gran., granular.

All prices per ton unless otherwise stated

Iodoform. Under 1 cwt., per lb., £1 2s 11d, for 1-cwt. lots, per lb., £1 2s 3d.
Lactic Acid. Pale tech., 44% by wt., per lb., 14d; dark tech., 44% by wt., per lb., 9d; chem. quality, 44% by wt., per lb., 12½d; 1-ton lots, ex-works, usual container terms.
Lead Acetate. White, about £154.
Lead Nitrate. 1-ton lots, about £135.
Lead, Red. Basis prices: Genuine dry red, £118 15s; orange lead, £130 15s. Ground in oil: red, £138 10s, orange, £150 10s.
Lead, White. Basis prices: Dry English in 5-cwt. casks, £127 5s; Ground in oil: English, 1-cwt. lots, per cwt., 194s.
Lime Acetate. Brown, ton lots, d/d, £40; grey, 80-82%, ton lots, d/d, £45.
Litharge. In 5-ton lots, £120 15s.
Magnesite. Calcined, in bags, ex-works, about £21.
Magnesium Carbonate. Light, comm., d/d, 2-ton lots, £84 10s under 2 tons, £97.
Magnesium Chloride. Solid (ex-wharf), £17 10s.
Magnesium Oxide. Light, comm., d/d, under 1-ton lots, £245.
Magnesium Sulphate. Crystals, £16.
Mercuric Chloride. Tech. powder, per lb., for 5-cwt. lots, in 28-lb. parcels, £1 4s; smaller quantities dearer.
Mercury Sulphide, Red. 5-cwt. lots in 28-lb. parcels, per lb., £1 9s 3d.
Nickel Sulphate. D/d, buyers UK, nominal, £170.
Nitric Acid. 80° Tw., £35.
Oxalic Acid. Home manufacture, min. 4-ton lots, in 5-cwt. casks, c.p., about £131.
Phosphoric Acid. Tech. (s.g. 1.700) ton lots, c.p., £100; BP (s.g. 1.750), ton lots, c.p., per lb. 1s 4d.
Potash, Caustic. Solid, 1-ton lots, £95 10s; liquid, £36 15s.
Potassium Carbonate. Calcined, 96/98%, 1-ton lots, ex-store, about £74 10s.
Potassium Chloride. Industrial, 96%, 1-ton lots, about £24.
Potassium Dichromate. Crystals and gran., per lb., in 5-cwt. to 1-ton lots, d/d UK, 1s 2½d.
Potassium Iodide. BP, under 1-cwt., per lb., 10s 3d; per lb. for 1-cwt. lots, 9s 9d.
Potassium Nitrate. 4-ton lots, in non-ret. pack, c.p., £63 10s.
Potassium Permanganate. BP, 1-cwt. lots, per lb., 1s 11½d; 3-cwt. lots, per lb., 1s 10¾d; 5-cwt. lots, per lb., 1s 10½d; 1-ton lots, per lb., 1s 10d; 5-ton lots, per lb., 1s 9½d. Tech., 5-cwt. in 1-cwt. drums, per cwt., £9 15s 6d; 1-cwt. lots, £10 4s 6d.
Salammoniac. Ton lot, in non-ret. pack, £47 10s.
Salicylic Acid. MANCHESTER: Tech., d/d, per lb., 2s 8½d.
Soda Ash. 58% ex-depot or d/d, London station, 1-ton lots, about £17 3s.
Soda, Caustic. Solid 76/77%: spot, d/d 1-ton lots, £33 16s 6d.
Sodium Acetate. Comm. crystals, d/d, £91.
Sodium Bicarbonate. Ton lot, in non-ret. pack., £18 10s.
Sodium Bisulphite. Powder, 60/62%, d/d, 2-ton lots for home trade, £46 2s 6d.
Sodium Carbonate Monohydrate. Ton lot, in non ret. pack, c.p., £57.
Sodium Chlorate. 1-cwt. drums, c.p. station, in 4-ton lots, about £85.
Sodium Cyanide. 96/98%, ton lot in 1-cwt. drums, £113 5s.
Sodium Dichromate. Crystals, cake and powder, per lb., 1s. Net d/d UK, anhydrous, per lb., 1s 1¾d. Net. del. d/d UK, 5-cwt. to 1-ton lots.
Sodium Fluoride. D/d, 1-ton lots and over, per cwt., £5; 1-cwt. lots, per cwt., £5 10s.
Sodium Hyposulphite. Pea crystals, £38; comm., 1-ton lots, c.p., £34 15s.
Sodium Iodide. BP, under 1 cwt., per lb., 14s 1d; 1-cwt. lots, per lb., 13s 2d.
Sodium Metaphosphate [Calgon]. Flaked, paper sacks, £133.
Sodium Metasilicate. D/d UK in 1 ton lots, 1 cwt. free paper bags, £27 10s.
Sodium Nitrate. Chilean refined gran. over 98%, 6-ton lots, d/d c.p., £29 10s.
Sodium Nitrate. 4-ton lots, £32.
Sodium Percarbonate. 12½% available oxygen, per cwt., in 1-cwt. kegs, £8 10s 9d.
Sodium Phosphate. D/d, ton lots: di-sodium, crystalline, £40 10s, anhydrous, £88; tri-sodium, crystalline, £39 10s, anhydrous, £86.
Sodium Silicate. 75-84° Tw. Lancs and Ches., 4-ton lots, d/d station in loaned drums, £11 17s 6d; Dorset, Somerset and Devon, per ton extra, £3 17s 6d; Scotland and S. Wales, extra, £3. Elsewhere in England, not Cornwall, extra, £1 12s 6d.
Sodium Sulphate [Desiccated Glauber's Salt]. D/d in bags, £20.
Sodium Sulphate [Glauber's Salt]. D/d, £18 10s to £18 15s.
Sodium Sulphate [Salt Cake]. Unground, d/d station in bulk, £8.
MANCHESTER: d/d station, £9 10s.
Sodium Sulphide. Solid, 60/62%, spot, d/d, in drums in 1-ton lots, £36 2s 6d; broken, d/d, in drums in 1-ton lots, £37 2s 6d.
Sodium Sulphite. Anhydrous, £71 10s; comm., d/d station in bags, £27-£28 10s.
Sulphur. 4 tons or more, ground, according to fineness, £20-£22.
Sulphuric Acid. Net, naked at works, 168° Tw. according to quality, £11-£12 12s 6d; 140° Tw., arsenic free, £9 2s 6d; 140°Tw., arsenious, £8 14s 6d.
Tartaric Acid. Per cwt.: 10 cwt. or more, £14; 1 cwt., £14 5s.
Titanium Oxide. Standard grade comm., rutile structure, £182; standard grade comm., anatase structure, £167
Zinc Oxide. Max. for 2-ton lots, d/d, white seal, £90; green seal, £88; red seal, £85.

SOLVENTS AND PLASTICISERS

Acetone. All d/d. In 5-gal. drums, £128 in 10-gal. drums, £118; in 40-45-gal. drums, under 1 ton, £93; 1-5 tons, £90; 5-10 tons, £89; 10 tons and up, £88; in 400-gal. tank wagons, £85.
Butyl Acetate BSS. 10-ton lots, £173.
***n*-Butyl Alcohol BSS.** 10 tons, in drums, d/d, £152.
***sec*-Butyl Alcohol.** All d/d. In 5-gal. drums, £168; in 10-gal. drums, £158; in 40-45-gal. drums, under 1 ton, £133; 1-5 tons, £130; 5-10 tons, £129; 10 tons and up, £128; in 400-gal. tank wagons, £125.

tert-**Butyl Alcohol.** 5-gal. drums, £195 10s; 40/45-gal. drums: 1 ton, £175 10s; 1-5 tons, £174 10s; 5-10 tons, £173 10s; 10 tons and up, £172 10s.

Diacetone Alcohol. Small lots: 5-gal. drums, £177; 10-gal. drums, £167. 40/45-gal. drums: under 1 ton, £142; 1-9 tons, £141; 10-50 tons, £140; 50-100 tons, £139; 100 tons and up, £138.

Dibutyl Phthalate. In drums, 10 tons, d/d, per ton, £225; 45-gal. drums, d/d, per lb., 2s 1d.

Diethyl Phthalate. In drums, 10 tons, per ton, £221; 45-gal. drums, d/d, per lb., 2s 0½d.

Dimethyl Phthalate. In drums, 10 tons, per ton, d/d, £200, 45-gal. drums, d/d, per lb., 1s 10½d.

Dioctyl Phthalate. In drums, 10 tons, d/d, per lb., 2s 8d; 45-gal. drums, d/d, per lb., 2s 9½d.

Ether BSS. 1-ton lots, drums extra, per lb., 1s 11d.

Ethyl Acetate. 10-ton lots, d/d, £145.

Ethyl Alcohol [PB 66 o.p.]. Over 300,000 p. gal. 2s 11¼d; d/d in tankers, 2,500-10,000 p. gal., per p. gal., 3s 1¾d. D/d in 40/45-gal. drums, p.p.g. extra, 1d. Absolute alcohol (75.2 o.p.), p.p.g. extra, 5d.

Methanol. Pure synthetic, d/d, £43 15s.

Methylated Spirit. Industrial 66° o.p.: 500-gal. and up, d/d in takers, per gal., 5s 4d; 100-499 gal. in drums, d/d, per gal., 5s 8¼d. Pyridinised 64 o.p.: 500 gal. and up, in takers, d/d, per gal., 5s 6d; 100-499 gal. in drums, d/d, per gal., 5s 10¼d.

Methyl Ethyl Ketone. All d/d. In 5-gal drums, £183; in 10-gal. drums, £173; in 40-45-gal. drums, under 1 ton, £148; 1-5 tons, £145; 5-10 tons, £144; 10 tons and up, £143; in 400-gal. tank wagons, £140.

Methyl *iso*Butyl Ketone. All d/d. In 5-gal. drums, £209; in 10-gal. drums, £199; in 40-45-gal. drums, under 1 ton, £174; 1-5 tons, £171; 5-10 tons, £170; 10 tons and up, £169; in 400-gal. tank wagons, £166.

***iso*Propyl Acetate.** In drums, 10 tons, d/d, £137; 45-gal. drums, d/d, £143.

***iso*Propyl Alcohol.** Small lots: 5-gal. drums, £118; 10-gal. drums, £108; 40-45 gal. drums: less than 1 ton, £83; 1-9 tons, £81; 10-50 tons, £80 10s; 50 tons and up, £80.

RUBBER CHEMICALS

Carbon Disulphide. According to quality, £61-£67.

Carbon Black. Per lb., according to packing, 8d-1s.

Carbon Tetrachloride. Ton lots, £83 15s.

India-Rubber Substitutes. White, per lb., 1s 8¾d to 2s 0½d; dark, d/d, per lb., 1s 3d-1s 5½d.

Lithopone. 30%, about £59.

Mineral Black. £7 10s-£10.

Sulphur Chloride. British, about £50.

Vegetable Lamp Black. 2-ton lots, £64 8s.

Vermilion. Pale or deep, 7-lb. lots, per lb., 15s 6d.

COAL-TAR PRODUCTS

Benzole. Per gal., min. 200 gal., d/d in bulk, 90's, 5s 3d; pure, 5s 7d.

Carbolic Acid. Crystals, min. price, d/d bulk, per lb., 1s 4d; 40/50-gal. ret. drums extra, per lb., ½d. Crude, 60's, per gal., 8s 4d.
MANCHESTER: Crystals, d/d, per lb., 1s 4d-1s 7d; crude, naked, at works, 8s.

Creosote. Home trade, per gal., according to quality, f.o.r. maker's works, 1s-1s 9d.
MANCHESTER: Per gal., 1s 2d-1s 8d.

Cresylic Acid. Pale 99/100%, per gal., 6s 6d; 99.5/100%, per gal., 6s 8d. D/d UK in bulk: Pale ADF, per imperial gallon f.o.b. UK, from 7s 8d to 9s 3d; per US gallon, c.i.f. NY, 100 to 118.5 cents freight equalised.

Naphtha. Solvent, 90/160°, per gal., 5s 1d; heavy, 90/190°, for bulk 1,000-gal. lots, d/d, per gal., 3s 11d. Drums extra; higher prices for smaller lots.

Naphthalene. Crude, 4-ton lots, in buyers' bags, nominal, according to m.p.: £19-£30; hot pressed, bulk, ex-works, £40; refined crystals, d/d min. 4-ton lots, £65.

Pitch. Medium, soft, home trade, f.o.r. suppliers' works, £10 10s; export trade, f.o.b. suppliers' port, about £12.

Pyridine. 90/160, per gal., 17s 6d-20s.

Toluole. Pure, per gal., 5s 9d; 90's, d/d, 2,000 gal. in bulk, per gal., 5s.
MANCHESTER: Pure, naked, per gal., 5s 6½d.

Xylole. According to grade, in 1,000-gal. lots, d/d London area in bulk, per gal., 6s 2d-6s 6d.

INTERMEDIATES AND DYES

(Prices Nominal)

m-**Cresol** 98/100%. 10 cwt. lots d/d, per lb., 4s 9d.

o-**Cresol** 30/31 °C. D/d, per lb., 1s.

p-**Cresol** 34/35 °C. 10 cwt. lots d/d, per lb., 5s.

Dichloraniline. Per lb., 4s 6d.

Dinitrobenzene. 88/99°C., per lb., 2s 1d.

Dinitrotoluene. Drums extra. SP 15°C., per lb., 2s 1¼d; SP 26°C., per lb., 1s 5d; SP 33°C., per lb., 1s 2¼d; SP 66/68°C., per lb., 2s 1d.

p-**Nitraniline.** Per lb., 5s 1d.

Nitrobenzene. Spot, 90 gal. drums (drums extra), 1-ton lots d/d, per lb., 10d.

Nitronaphthalene. Per lb., 2s 5½d.

o-**Toluidine.** 8-10-cwt. drums (drums extra), per lb., 1s 11d.

p-**Toluidine.** In casks, per lb., 6s 1d.

Dimethylaniline. Drums extra, c.p., per lb., 3s 5d.

Chemical Stocks & Shares

Investment 'Bargains'

AFTER the shock last week of the increased Bank Rate to 7 per cent from 5 per cent, markets over the weekend have had time to adjust themselves to this 7 per cent crisis level. A certain time must elapse before the full effects from industry and abroad are seen. But already markets are focussed on the firmer sterling rate, which has commanded a great deal of foreign support, and are looking decidedly better.

1957 High	1957 Low		24 Sept.	Change on last two weeks
23/7½	17/6	Albright & W. 5/-	18/3	—3/1½
11/6	10/6	Anchor 5/-	10/6	—1/-
1/2½	1/-	Ashe 1/-	1/1½	—
24/6	20/-	Bakelite 10/-	22/-	—1/9
7/10½	5/-	Berk 5/-	5/-	—9d
36/-	22/4½	Borax Dfd. 5/-	22/6	—3/-
10/9	9/-	Bt. Chrome 5/-	10/-	—9d
13/10½	10/3	Bt. Glues 4/-	11/1½	—1/-
6/4½	4/9	BIP 2/-	5/3	—6d
8/6	5/6	Bt. Tar 2/6	7/6	—7½d
35/-	27/3	Bt. Xylonite	27/6	—3/3
22/3	17/6	Brothertons 10/-	17/9	—2/-
4/4½	3/7½	Coalite 2/-	3/10½	—4½d
60/3	48/3	Fisons	50/4½	—3/4½
43/-	24/-	Glaxo 10/-	35/-	—4/6
9/6	8/-	Hardman & H. 5/-	9/-	—3d
34/6	24/1½	Hickson & W. 10/-	31/3	—3/-
46/3	38/10½	ICI	39/6	—1/7½
4/9	2/7½	Kleeman 1/-	3/1½	—1½d
22/1½	15/3	Laporte 5/-	15/4½	—2/4½
22/-	17/-	Lawes 10/-	18/3	—1/3
19/3	12/4½	Monsanto 5/-	14/6	—3/-
15/6	12/9	Reichhold 5/-	13/4½	—1/1½
11/9	9/-	Yorkshire Dye. 5/-	11/-	—3d

Investors at this complex juncture are naturally hesitant as to the best course to follow, but providing the Government's stringent monetary policy takes effect, good class chemical equities should not be sold. At today's low prices, profit and dividend effects on industry have been far too greatly discounted. Now seems the time, therefore, to select one or two good class shares to be purchased at 'give-away' prices. Below is suggested six such companies together with the share price, dividend and yields. These held over a two-to-three-year period should prove to be a good investment with potential capital appreciation.

Stock	Price	Dividend %	Yield
ICI	39/6	10	101/3
Borax 5/- Dfd. ...	22/6	8½	37/-
Hickson and W. 10/- ...	31/3	15	96/-
Laporte Ind. 5/- ...	15/4½	16	104/-
Brotherton 10/- ...	17/9	12½	140/9
Monsanto	14/6	13½	93/-

Semiconductors to Build New Transistor Plant

A SPECIALLY designed factory is to be built by Semiconductors Ltd. on the Cheney Manor Estate, Swindon, solely for the manufacture of transistors. To ensure that the transistors are free from impurities which could reduce reliability or give rise to deviations from the designed electrical characteristics, the factory will have air-conditioning equipment.

Production is expected to start during 1958 with the manufacture of high frequency surface barrier and micro-alloy types currently produced by Lansdale Tube Co. of the US. Silicon alloy versions for high frequency operation over a wide range of temperatures will also be produced. Later in 1958, germanium micro-alloy diffused transistors will also be available.

In the meantime to allow industry to develop equipment containing these transistors, Semiconductors are making sample quantities available from the US.

Semiconductors are owned 51 per cent by Plessey Ltd. and 49 per cent by Philco of the US. Electro-chemical techniques developed by Philco in the US will be used in manufacturing the transistors. These techniques are said to give unusually close control of tolerances.

Chemicals Exempted from Key Industry Duty

UNDER an order made by the Treasury, the following chemicals are exempted from Key Industry Duty for the period 23 September 1957 to 18 February 1958:

Ambrettolide, butylchloral hydrate, (-) carvone, 5-ethyl-2-sulphanilamido-1:3:4 thiadiazole (a substituted arylsulphoamide), 3-methylindole, pinacol (a hexanediol), triethyl orthoacetate (an ethyl ester), triethyl orthopropionate (an ethyl ester).

The order is the Safeguarding of Industries (Exemption) (No. 8) Order, 1957. Copies may be obtained from HM Stationery Office or through any bookseller.

Visit to Pure Chemicals

Lord Derby recently inspected the plastics research and technical service laboratories of Pure Chemicals Ltd., at the Kirkby Industrial Estate, Liverpool.

Commercial News

British Industrial Plastics Anticipate a Record Turnover

TURNOVER of British Industrial Plastics Ltd. has increased in the first 10 months of the financial year and the directors consider there is no reason to believe that the turnover for the whole year should not again be a record.

Group profits, before tax, are expected to be similar to those of 1955–56 (£616,000).

A dividend of 20 per cent for the year to 30 September next is foreshadowed. An interim of 7½ per cent (same) has already been paid.

In April this year, the company acquired exclusive rights for the British Commonwealth for a process for the manufacture of glass-fibre reinforced polyester resin sheeting by a continuous process developed by the Filon Plastics Corporation at El Segundo, California. British Industrial Plastics Reinforced Products, a BIP wholly owned subsidiary, will be manufacturing the sheeting in a newly built factory adjoining the BIP Streetly Works. Production is expected to start early in the new financial year.

The parent company is maintaining as far as possible the existing price levels of its chemical factories' products and by improved methods of production, increases in wages and materials have been absorbed.

Ashe Chemical Co.

Interim dividend for 1957 on ordinary shares has been increased by Ashe Chemical Co. Ltd. from 3 to 5 per cent. Total dividend declared for 1956 was 10 per cent.

British Celanese Ltd.

Competition both at home and abroad resulting in slightly lower prices, combined with high costs have caused a fall in group profits of British Celanese Ltd., from £3,308,528 to £2,526,429 for the year ended 30 March, 1957. Net profit was £650,661 compared with £1,227,216.

Net capital expenditure on buildings, plant and machinery during the year amounted to £1,440,000 and at the end of the financial year, unexecuted contracts for capital expenditure totalled £253,000

As has been announced, the year's dividend on Ordinary is 4½ per cent.

Power-Gas Corp.

An interim dividend of 5 per cent for the year to 30 September 1957 on £1.4 million capital as increased by last year's rights issue has been declared by the Power-Gas Corporation. Previously single yearly payments were made by the company, that for 1955-56 being 14 per cent on £1 million.

United Indigo and Chemical

A further reduction in the dividend from 6¼ per cent to 5 per cent, on the 5 per cent cumulative participating preference shares and on ordinary shares, has been announced by United Indigo and Chemical for the year to 30 June, 1957. Payment of 7½ per cent was made in 1954-55.

Group profits have fallen from £5,156 to £2,526, after UK tax of £962 (£4,727), but before profits tax distribution charge of £1,328 (£1,700).

Tube Investments

Agreement has been reached by Tube Investments and the Reynolds Metals Group of the US to combine the interests and activities of both groups in the aluminium industry in the UK. Subject to Treasury approval, the agreement provides for the formation of a new company to be known as Reynolds Metals and TI Aluminium which will take over all TI Aluminium's existing aluminium undertakings. The company will be owned equally by TI and Reynolds.

According to the announcement, technical research, commercial and metal supplies from both companies will support the new company for which 'an active development and expansion plan is intended'.

Chairmanship of the new company is to alternate between Sir Ivan Stedeford, chairman of Tube Investments, and Mr. Richard S. Reynolds Jnr., president of Reynolds Metals Co. Sir Ivan will be the first chairman.

FOR YOUR DIARY

1 OCTOBER

Incorporated Plant Engineers—Edinburgh, 25 Charlotte Square. 7 p.m. Paper, 'Practical plant engineering in the chemical industry' by C. W. Winstock.

2 OCTOBER

Incorporated Plant Engineers—Portsmouth, Royal Beach Hotel. 7.30 p.m. Paper, 'The engineer and the Clean Air Act', by E. C. Rogers.

National Smoke Abatement Society—Hastings, White Rock Pavilion. 10.30 a.m. 24th Annual Conference. Until 4 October.

Society for Water Treatment and Examination—Southend-on-Sea, Palace Hotel. Annual meeting. Until 4 October.

3 OCTOBER

Institute of Metals—London, 17 Belgrave Square, SW1. 6.30 p.m. Paper, 'Fourteen Elements', by E. C. Rhodes.

5 OCTOBER

Society for Analytical Chemistry—Manchester, Engineers' Club, Albert Square. 2.15 p.m. Discussion, 'The analysis of trade effluents'.

Market Reports

MANCHESTER'S BANK RATE FEARS

LONDON There has been a good movement of supplies to the chief home consuming industries mainly against contracts, but there has also been a fairly active interest in fresh business on home account, while the demand for export remains steady. Industrial chemical prices show no definite trend but the undertone is firm.

Basis prices for dry white lead and red lead are lower from Wednesday, 25 September at £127 5s and £118 15s a ton respectively; litharge is quoted at £120 15s a ton.

Pitch continues to be an active item in the coal-tar products market and there is a good outlet for the light distillates.

MANCHESTER In common with most other trades the effect on the demand for chemical products of the tightening of credit restrictions is regarded with apprehension on the Manchester market. Up to the present there has been no pronounced effect, but it is feared that the demand for a wide range of textile and other industrial chemicals will fall off before long and that there will be adverse effects also on export business. Trade in fertilisers may likewise be hit. For the present, however, the movement into consumption has been on much the same scale as during recent weeks.

GLASGOW The Scottish heavy chemical market has been very active during the past week, with a good volume of business being received from most sections of industry. Contract requirements have been well demanded, together with the placing of some requirements for forward delivery. There is still a good level of business being maintained in regard to the export market, while on the agricultural side the position remains rather quiet. Prices on the whole continue fairly steady.

Photo by courtesy of Ashdowns Ltd., St. Helens, Lancs, who use Araldite for pipes available in lengths up to 8 ft. 6 in. and diameters up to 2 ft.

Araldite epoxy resins are supplied in many forms to solve almost every problem of corrosion. The ducting in our photograph, for example, withstands the passage of corrosive fumes containing solvent vapours at temperatures up to 100°C. It is formed of glass cloth impregnated with Araldite laminating resin to provide pipes of amazing toughness and durability which are, nevertheless, light and easy to handle. Araldite resins are available, too, as casting and coating resins and as cements or putty for uses wherever outstanding chemical resistance is required. Valves and other components for chemical plant are produced by simple gravity casting techniques in which shrinkage on curing is negligible. Both cold-curing and stoving finishes offer remarkable adhesion to most types of surface.

Araldite

epoxy resins

Araldite is a registered trade name.

Araldite epoxy resins are used

- ★ **for bonding metals, porcelain, glass, etc.**
- ★ **for casting high grade solid electrical insulation**
- ★ **for impregnating, potting or sealing electrical windings and components**
- ★ **for producing glass fibre laminates**
- ★ **for making patterns, models, jigs and tools**
- ★ **as fillers for sheet metal work**
- ★ **as protective coatings for metal, wood and ceramic surfaces**

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AP362

Water Pollution in Mersey River Board Area

Ferodo's Biological Filtration Plant

'BOWER'S BROOK, a small tidal stream of some three miles in length, runs mostly in culvert and into which the effluents from several chemical works discharge. The culvert is in places inadequate in size, frequently silted up with debris, in an unstable condition, due to chemical corrosion and lack of repair, and extremely difficult to maintain due to the highly poisonous gases present,' states the 6th annual report (1956-57) of the Mersey River Board.

A scheme of improvement prepared by the board has been approved by the various authorities and industrial firms concerned. The scheme, which will cost some £80,000, includes a twin culvert, specially lined to resist chemical attack, under the Sankey Canal, a new and shorter outfall into the River Mersey estuary, and repairs to certain limited lengths of existing culvert.

Results of quarterly chemical surveys of the main rivers in the board's area, in accordance with the sampling scheme begun in April, 1953, have shown, if anything can be deduced from such a short period, that there has been a slight improvement in the condition of the streams compared with the previous year.

Areas of Pollution

The River Sett, nearly seven miles long, rises on the south slopes of Kinder Low in Derbyshire, and flows west through the village of Hayfield before joining the River Goyt at New Mills. Its upper reaches above Hayfield are 'very clean' since they are made up largely of compensation water (1,080,000 gall. a day) from the Kinder Reservoir of Stockport Corporation as well as a number of unpolluted moorland streams. In the middle reaches beween Hayfield village and Birch Vale there are satisfactory discharges from a small printworks (150,000 gall. a day) a paper manufacturer (300,000 gall. a day), and a sewage works (Chapel en-le-Frith, Hayfield DWF 78,000 gall. a day) and the stream water is 'fairly clean.'

Main pollutions occur at the lower end of the stream at Birch Vale and consist of the following:

(a) A large volume (1,500,000 gall. a day) of calico printers' waste. Although this is normally satisfactory or borderline, the volume is of the same order of magnitude as the stream, and as a result of this lack of dilution the effect on the river is bad.

(b) Alkaline organic wastes from the bleaching and dyeing of cotton and rayon. The company concerned has recently installed a new purification plant and is now experimenting with the use of precipitant.

Cost of making polluted water usable in a factory can be substantial; a paper works in the Irwell valley, one of many such water users, spends over £11,500 a year in water treatment. At the point where the Mersey is about to become tidal, Warrington CB take in much of the river water for rough treatment before being distributed for industrial use. This plant is being enlarged to try to cope with the growing demand; but even with the existing treatment the river can at times give rise to complaints at the user end.

In the report it is stated that 'the continued attack by water authorities on compensation water underlines the need to keep rivers used for industry as clean as possible as there is little dilution by clean compensation water even in wet weather.' The compensation water at the head of the River Etherow, for example, when this question was last investigated was the only water coming from the reservoirs on 300 days in the year, and some years before, on the River Goyt, the figure was 284.

Mention is made of 'the factory of Ferodo Ltd., the largest of its kind in the world, which is principally engaged in the manufacture of brake and clutch linings, some of which are impregnated with synthetic resins of the phenol-formaldehyde type.'

According to the Mersey River Board report the chief wastes, those from the resin manufacture, contain cresols, methyl alcohol, and formaldehyde, and at one time caused serious pollution of the Black Brook, a small tributary of the River Goyt, where only an inadequate dilution is available. Other waste waters produced at this factory include those from (a) removal of volatile substances from impregnated brake linings, (b) the use of alkalis, (c) recovery of solvent vapours, (d) drainage from research laboratory, and (e) water treatment and boiler-house waste water.

As a result of investigations by the Water Pollution Research Laboratory, it was found that small scale percolating filters could be used to purify and oxidise the phenols in the most polluting of the waste waters, namely those from the resin manufacture. On the basis of these experiments, a large scale plant was constructed by the firm to deal with the wastes of biological filtration.

In view of the fact that there are only a few trade effluent plants in this country using biological methods of treatment, the results of the operation of this plant may be of interest. It was completed in August, 1953, costing £32,000 and comprises (1) four upward flow sedimentation tanks, (2) two rectangular percolating filters fitted with power-driven travelling distributors, and (3) two humus tanks—drying beds are provided for sludge disposal.

Filter Acclimatisation

In starting up, domestic sewage was first fed to the plant, then some trade waste was added. The proportion of trade waste to sewage was gradually increased, in order to acclimatise the micro-organisms in the filter media, until eventually the plant was dealing with trade waste only. The flow of about 600,000 gall. a day consists of about 4,000 gall. a week of partially treated wastes from resin manufacture, (containing cresols and some xylenols), cooling water, and other wastes listed above. The biological filters are dosed at about 250 gall. per cubic yard a day but the company are carrying out experiments on the effect of recirculation which they hope to introduce in the near future. The settled influent to the filters usually has a 4-hours permanganate value of 30-250 p.p.m. and a phenols content of 10-100 p.p.m. The final effluent from the humus tank conforms to Royal Commission sewage effluent standards and generally has a low content of phenols.

New British Standards for Petroleum

Two latest additions to the series of British Standards have been issued in order to give national standards status to methods of test published by the Institute of Petroleum. These are determination of tetraethyl lead in gasoline (hydrochloric acid method) (B.S. 2878:1957), and determination of water and sediment in crude and fuel oils (B.S. 2882:1957).

Requirements for the apparatus, reagents used, and the procedure for carrying out the tests are specified and the methods of calculating and reporting results laid down.

Copies of these Standards may be obtained from British Standards Institution, Sales Branch, 2 Park Street, London W1 B.S. 2878, price 3s; B.S. 2882, price 4s.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents),' which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 3s 3d including postage; annual subscription £8.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection on 30 October

Azone manufacture. Air Reduction Co., Inc. **785 671**

Monoazo dyestuffs of the 2-hydroxy-3-naphthalic acid arylamide series. Farbenfabriken Bayer AG. **785 672**

Catalytic recombiner. North American Aviation, Inc. **785 420**

Treatment of water. Giulini Ges., Geb. **785 626**

Preparation of cereal starch. Bernheim, C. M. **785 522**

Preparing a glucosamine. American Home Products Corp. **785 525**

Substituted pteridine derivatives. Merck & Co., Inc. [Divided out of 785 351.] **785 353 785 354 785 355**

Plant for recovering vaporisation and condensation products, sublimates, dusts and the like, from outgoing air of furnace rooms in aluminium electrolysis. Vereinigte Aluminium-Werke AG. **785 429**

Nuclear reactor plant. Allmanna Svenska Elektriska Aktiebolaget. **785 528**

Mixed fertilisers consisting of basic slag and potassium salts. Wintershall **766 923**

Open to public inspection on 6 November

Manufacture of uranium tetrachloride. Polissar, M. J. **785 973**

Refining of fluorocarbons. Benning, A. F. **785 974**

Neutron-irradiated structures. UK Atomic Energy Authority. **785 876**

Purification of germanium. National Research Development Corp. **785 751**

Surface treatment of aluminium. Acorn Anodising Co., Ltd. **785 877**

Process and apparatus for chemical nickel plating. General American Transportation Corp. **785 693**

Thermosetting etherified resins. British Resin Products, Ltd. **785 930**

Steriod compounds. Merck & Co., Inc. **785 681 785 682**

Process and bath for the chemical plating of a catalytic material with nickel. General American Transportation Corp. **785 694**

Basically substituted carboxylic acid amides. Farbwerke Hoechst AG. **785 975**

Tanks for combined transport of liquids and solids. Naggiar, J. Y. M. **785 710**

Electrodeposition of bright nickel. Harshaw Chemical Co. **785 931**

Thermosetting moulding compositions. McCoy, W. C., and McCoy, jun., W. C. **785 976**

Carrying out industrial processes in a glow discharge. Berghaus, B. **785 878**

Flame resistant film-forming composition. Celotex Corp. **785 977**

Solvents and softeners for polyesters of terephthalic acid with aliphatic dihydroxy-compounds. Farbwerke Hoechst AG. **785 789**

Reaction apparatus for carrying out exothermic gas reactions. Rheinpreussen AG Fuer Bergbau und Chemie. **785 752**

Production of lithium carbonate. English Clays Lovering Pochin & Co., Ltd., and Warren, I. H. **785 979**

Hydrocarbon drying oil production. Esso Research & Engineering Co. **785 703**

Preparation of fatty acid esters suitable for use as ointment bases and the like carrier media. Edelfettwerke Ges. **785 933**

Fertiliser materials. Fisons, Ltd. **785 934**

Insolubilising artificial filaments, threads, fibres, and the like obtained by the spinning of solutions of proteins. Imperial Chemical Industries, Ltd. **785 881**

Manufacture of synthetic filaments, fibres or yarn. British Nylon Spinners, Ltd. **785 978**

Production of cyclopentadiene compounds of transition elements. Union Carbide Corp. **785 760**

Preparation of pteridine derivatives. Merck & Co., Inc. **785 715**

Synthetic rubber-like materials. Imperial Chemical Industries, Ltd. **785 882**

Water-soluble polymerisable polyesters. General Electric Co. **785 980**

Incorporation of solid materials in oil. Texaco Development Corp. **785 936**

Biguanides. Imperial Chemical Industries, Ltd. **785 937**

Production of polyvinyl compounds. Newby, H. (Chemische Werke Hüls AG). **785 938**

Method for adding ferrosilicon while simultaneously desulphurising or deoxidising a molten metal or alloy. Hurum F. G. O. **785 719**

Isolation of the antibiotic neomycin. Boots Pure Drug Co., Ltd. **785 982**

Production of thiadiazole derivatives. Ilford, Ltd. **785 939**

Production of polymeric and copolymeric products. Courtaulds, Ltd. **785 983**

Method of refining hydrocarbons or hydrocarbon fractions by catalytic hydrogenation. Metallges AG. **785 765**

Carbonylation of olefinic compounds. Esso Research & Engineering Co. **785 985**

Separation of fluidised particles in transfer line reactors and processes. Esso Research & Engineering Co. **785 797**

Manufacture of alkali cellulose by cellulose slurry-steeping. Rayonier, Inc **785 890**

Oestrogenic substances. National Research Development Corp. **785 987**

Process of electrolysis of aqueous electrolytes for producing bromine and iodine. Makhtsavei Israel. **785 723**

Basic monoazo dyes of the benzene-azobenzene series. Du Pont De Nemours & Co., E. I. **785 988**

Plant treating materials. Diamond Alkali Co. **785 989**

Cylic alkanediol esters of alkyl boronic acid and motor fuels containing these esters. Standard Oil Co. **785 724**

Pesticidal organic phosphorus compounds. Hercules Powder Co. **785 990**

Process for removing metals from hydroformylation products. Gulf Research & Development Co. **785 991**

Production of hair dyes. Soc. Monsavon-L'Oreal. **785 725**

Preparation of 1-alkynes. British Oxygen Co., Ltd. [Addition to 709 126.] **785 727**

Quaternary ammonium salts. Imperial Chemical Industries, Ltd. **785 992**

Resinous compositions and fire resistant laminates prepared therefrom. Westinghouse Electric International Co. **785 731**

Di-pyridyl derivatives. Imperial Chemical Industries, Ltd. **785 732**

Fluid cooking process. Esso Research & Engineering Co. [Addition to 752 400.] **785 994**

Stabilisation of phenol compounds. Imperial Chemical Industries, Ltd. **785 951**

Fractionation in coker scrubber of heavy gas oils containing a high concentration of metal contaminants. Esso Research & Engineering Co. **785 805**

Preparation of titanium carbide, boride or nitride. National Lead Co. **785 995**

Apparatus for injection moulding polymers of halogen-containing vinyl compounds. Chemische Werke Hüls AG. **785 996**

Physical treatment of solutions of organic acid esters of cellulose. Celanese Corp. of America. **785 806**

Recovery or uranium products from solutions containing hexavalent uranium. Aktiebolaget Atomenergi. **785 997**

Methods of and apparatus for analysing gases. Feichtinger, H. **785 815**

Preparation of di-halo-glycol diether. Bozel-Maletra Soc. Industrielle de Produits Chimiques. **785 998**

Process for bleaching waxes, fatty oils and fats. Farbwerke Hoechst AG. **785 999**

Production of regenerated cellulose threads and films from viscose. Vereinigte Glanzstoff-Fabriken AG. **785 818**

Stabilised solutions of hydrocortisone. Merck & Co., Inc. **785 819**

Odour inhibited polyethylene. Union Carbide Corp. **786 000**

Gasifying finely divided fuels which are in suspension. Koppers Ges., H. **785 899**

Chemical nickel plating process and apparatus. General American Transportation Corporation. [Divided out of 785 693.] **785 697**

Dehydro-beta carotene and the manufacture and conversion thereof. Hoffman-La Roche & Co., AG. **786 003**

Calcium carbide by the oxygen-thermal process. Badische Anilin- & Soda-Fabrik AG. **786 004**

Primary aliphatic amines and/or their hydrohalides and process of producing the same. Olin Mathieson Chemical Corp. **786 006**

Thiazolo-pyrimidines. Wellcome Foundation, Ltd. (Burroughs Wellcome & Co. (U.S.A.), Inc.). **786 007**

Continuous production of hydrogels containing silicic acid. Badische Anilin- & Soda-Fabrik AG. **785 779**

Metal working lubricating compositions. Naamlooze Vennootschap Petroleum Maatschappij. **785 780**

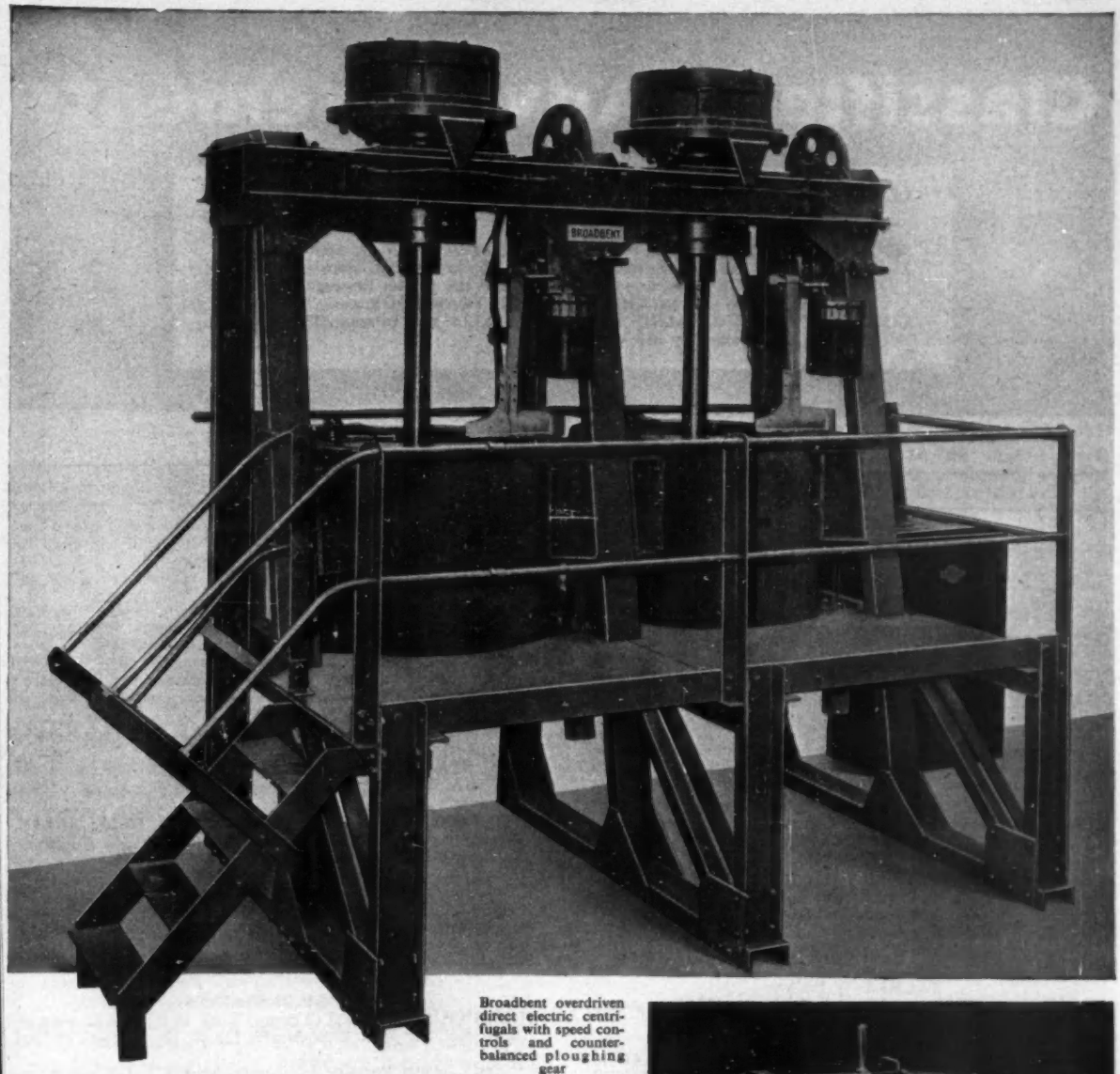
Phenthiazine derivatives. Soc. Des Usines Chimiques Rhone-Poulenc. **786 009**

Carbonisation of carbonaceous materials. Kellogg Co., M. W. **785 863**

Alkoxy-thiono-fluoro-phosphoric acid derivatives. Farbenfabriken Bayer AG. **786 013**

Polymerisation of normally gaseous mono-olefins. Standard Oil Co. **786 014**

Arrangement for gasifying finely divided solid fuels in suspension. Koppers Ges., H. [Addition to 732 019.] **785 909**



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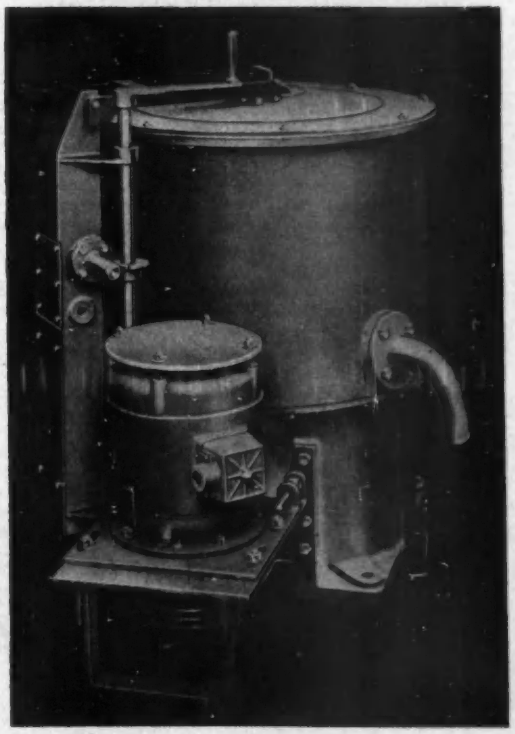

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